

BYTE

Java's

THE ANSWER—FOR 8 BUSINESS PROBLEMS

# BYTE

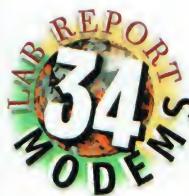
THE FUTURE OF INFORMATION TECHNOLOGY TODAY OCTOBER 1997 [www.byte.com](http://www.byte.com)

news/ ALLCHIN ON NT'S FUTURE... reviews/ IBM THINKPAD 770, CYBERMAX, 6x86, & MORE...

SPECIAL  
NETWORK  
ISSUE

# YOUR Next Net

Broadband  
bonanza—  
7 effective  
alternatives  
to ATM



Everything you need to know  
about high-end modems: 56k,  
ISDN, and DSL technology tested

Pentium II  
with Accelerated  
Graphics Port—  
Who Needs It?

HOT TECHNOLOGY  
Voice Networking /p107

SMOKING! New PowerPCs  
Hit 300 MHz /p133

A KINDER, GENTLER WEB  
with Thin Servers /p129



International Edition

10 >



£2.50 U.K./Lit. 9,000 ITALY/ATS 67/\$3.50 U.S.A.

A Publication of The McGraw-Hill Companies/0360-5280



IF WE  
MADE  
OUR COMPUTERS  
ANY EASIER  
TO MANAGE  
YOU'D BE  
OUT OF A JOB.



At Micron, we build computer systems that make everyone's work easier. We pack our hardy Micron™ VetiX™ MXI full of features like redundant power supplies and the latest high-degree, fault-tolerant components, including hot-swappable hard drives and more. And we make our entry level LXI models expandable, reliable and tough. Complement our servers with a Micron ClientPro® desktop. We've designed it to be easy to set up, easy to upgrade and easy to network, so you reduce potential downtime and increase productivity. For the employee on the go, try our TransPort™ XKE notebook. A true desktop replacement, we've loaded the XKE with a high-performance graphics accelerator, active matrix screen, upgraded CD-ROM, tons of memory and more. And, our TransPort VLX offers flexibility and sleek styling for an impressive price.

Call now to order.  
800•362•7306  
[www.micronpc.com](http://www.micronpc.com)

Circle 116 on Inquiry Card.



THINKING OUT OF THE BOX

## EXTENDING THE ENTERPRISE

# YOUR NEXT NET



### BUILDING NETWORK APPS

#### Java Gets Down to Business

87

By Tom Halfhill

Critics say Java isn't ready for prime time. Meanwhile, people are using it to solve real problems.

### BUILDING NETWORK APPS

#### CORBA, Java, and the Object Web

95

By Robert Orfali, Dan Harkey, and Jeri Edwards

Today's Web is too small for client/server computing. The future of the Web is the Object Web.



### ATM's Shrinking Role

58

By Scott Mace

ATM, once the killer network, is under attack from frame relay, Gigabit Ethernet, and IP.

### Preparing for Gigabit Ethernet

63

By Mike Hurwitz

10 tips for rolling out this high-speed technology.

### Batter Up for Broadband

71

By Mark Brownstein

Digital Subscriber Line services are arriving, as is one-way wireless broadband service.

### Bandwidth on a Budget

76

By BYTE Editors

Our tests will help you pick the right remote-access technology: 56K, ISDN, or ADSL.

## INTERNATIONAL

### VPNs Proliferate

32IS 7

### Fast-Forward to Fast Ethernet

32IS 15

### Speak Naturally

32IS 19



### MANAGING DATA

#### Debunking Object-Database Myths

101

By Joe Celko and Jackie Celko

Object databases are no longer lab curiosities. Here's what they can do.

### NETWORK INTEGRATION

#### Data Networks Speak Up

107

By Alan Joch

Voice over frame relay or IP has improved. But the technology is still for internal use only.



## EDITORIAL

10

## INBOX

13

## BITS

AGP: Who Needs It?	18
Servers Thin and Cheap	19
Ink-Jets Move Up	22
Bugs on Mars	23
Bandwidth Accounting	23
NT Clustering	26
What's Next for Windows	32

## EVAL

DESKTOP PC	
First 6x86 PC: Generally a Winner	33
CyberMax's Cyrix machine.	
DEVELOPMENT TOOLS	
JBuilder Makes Java a Piece of Cake	34
Borland's JBuilder.	
NOTEBOOK	
The Best ThinkPad Gets Better	37
IBM's model 770.	
VIDEOCON SERVER	
A New MeetingPoint for Videoconferencing	38
White Pine's MeetingPoint.	

DATABASES	
Farming the Web	43
By Richard Hackathorn	
You can harvest content for information that's crucial to your strategic decisions.	
OPERATING SYSTEMS	
A New Epoch for Hand-Helds	45
By Dick Pountain	
Psion's OS provides a micro-kernel and sophisticated real-time services.	

## LAB REPORT

### HARDWARE

#### Bandwidth on a Budget

76

By BYTE Editors

Our modem tests will help you choose: 56K, ISDN, or ADSL?



### SOFTWARE

#### The Object Is to Manage Data

122

By Todd Zino

When you're tracking large, complex data types, you need an object database management system. We test three of them.

## WEB PROJECT

### Next-Generation News Servers

113

By Jon Udell

With the latest from Netscape and Microsoft, mere mortals can deploy newsgroups.

## REVIEWS

### WEB APPLIANCES

#### Web Servers Get Skinny

129

We check out easy-to-manage systems from Compact Devices, Microtest, and Webtronics.

### POWER MACS

#### Three for Speed

133

It's a close race between these screaming machines from Apple, Motorola, and Umax.



## JAVATALK

### Rebuilt Parts

117

By Rick Grehn

ObjectShare's Parts for Java provides an excellent programming environment.

## CHAOS MANOR

### Virtual Publishing—and Virtual Travel

139

By Jerry Pournelle

After a stop in the anteroom to Purgatory, Jerry takes to the air with a new laptop and muses on some virtual possibilities.

### INTERNET SERVICES

#### Novell's Internet/IntranetWare Connection

137

BorderManager bundles internetwork services for NetWare administrators.

## CORE

### NETWORKING

#### Smarter and Faster IP Connections

47

By Mick Seaman

New IP switch designs help move low-latency data through large nets.

### CPUS

#### Keeping It Simple

51

By Tom R. Halfhill

A new Pentium-class processor from a stealth start-up rebels

against current design trends with a vastly simplified micro-architecture.

### PROGRAMMING

#### Programming in Limbo

53

By Larry Rau

This language allows you to easily write threaded programs with bidirectional communications.

## WHAT'S NEW

167

Digital's HiNote notebook, Microsoft's FrontPage 98, plus processor upgrades, a math tool, and crypto accelerators.



## IMPROBABLE

### Advances and Retreats in Computing

172

Just like Kiss and Fleetwood Mac, the green screen just won't stay away.

## SERVICE

### Reader Service

Inquiry Reply Cards 164A-B

### Index to Advertisers

Alphabetical Order 164

### Editorial Index

by Company 166

### THE BYTE WEB SITE and THE VIRTUAL PRESS ROOM

<http://www.byte.com>

### PROGRAM LISTINGS

FTP: <ftp://ftp.byte.com>  
From BIX: Join "listings/ frombyte97" and select the appropriate subarea (i.e., "oct97").

BYTE (ISSN 0360-5280) is published monthly by The McGraw-Hill Companies, Inc. U.S. subscriber rate \$24.95 per year. In Canada and Mexico, \$34.95 per year. European surface mail subscriptions \$60, airmail \$85. Non-European subscriptions, \$60 surface mail or \$85 airmail. All foreign subscriptions are payable in U.S. funds that can be drawn on a U.S. bank. Single copies \$3.95 in the U.S., \$4.95 in Canada. Executive, Editorial, Circulation, and Advertising Offices: 29 Hartwell Ave., Lexington, MA 02173. Periodicals postage paid at New York, NY, and additional mailing offices. Postage paid at Winnipeg, Manitoba, Canada. Post International Publications Mail Product Sales Agreement No. 246492. Registered for GST as The McGraw-Hill Companies, Inc., GST #12305673. Postmaster: Send address changes and fulfillment questions to BYTE Subscriptions, P.O. Box 552, Hightstown, NJ 08520. Printed in the United States of America.

## CONTENTS BY PLATFORM

### WINDOWS

AGP: Who Needs It? ..... 18  
Systems that use Intel's 440LX chip set to optimize performance have arrived, but the necessary software has not.

NT Clustering Solutions Compared ..... 26  
Microsoft's Wolfpack isn't the only software offering improved availability.

Windows Wish List ..... 32  
Microsoft VP Jim Allchin tells us what he'd like to see in future versions of Windows.

First 6x86 PC: Generally a Winner ..... 33  
CyberMax's Cyrix-based system is a good Windows machine with fast components.

The Best ThinkPad Gets Better ..... 37  
IBM's 770 raises the bar for multimedia notebooks.

Keeping It Simple ..... 51  
Centaur's IDT-C6 is an x86-compatible processor that's cheaper than a Pentium yet has larger caches and can execute MMX instructions.

The Object Is to Manage Data ..... 122  
We check out three object databases that run under NT.

Virtual Publishing—and Virtual Travel ..... 139  
Win 95 runs fine on Jerry's new laptop, but he still wants a better word counter.

### MACINTOSH

Three for Speed ..... 133  
New Power Macs scream, come loaded with goodies, and intensify the race between Apple, Umax, and Motorola for the perfect system.

### UNIX

The Object Is to Manage Data ..... 122  
For tracking large, complex data types, you need an object database. We check out three

that run under Unixes: Object Design's ObjectStore, O2 Technology's ODMG, and Versant's Versant.

### DATABASE TECHNOLOGY

Farming the Web ..... 43  
Gleaning good information from the Web can make your data warehouse more valuable.

Debunking Object-Database Myths ..... 101  
Conventional wisdom about object databases is seriously out of date.

The Object Is to Manage Data ..... 122  
We check out three ODBMSes.

NETWORKING

File Servers Get Thinner, Cheaper ..... 19  
New devices let you add storage for workgroups without having to buy a new file server.

Better Networks Through Accounting ..... 23  
New applications let you see who's using your network, and how much.

Smarter and Faster IP Connections ..... 47  
Two IP switch architectures promise better performance.

ATM's Shrinking Role ..... 58  
New incarnations of IP, Gigabit Ethernet, and frame relay are making inroads against ATM.

Preparing for Gigabit Ethernet ..... 63  
Avoid upgrade problems with these 10 tips.

Batter Up for Broadband ..... 71  
Digital Subscriber Line will ramp up rapidly in 1998. So will LMDS wireless.

Bandwidth on a Budget ..... 76  
Choosing the correct remote-access product means navigating through competing technologies. Our tests will help.

Java Gets Down to Business ..... 87  
BorderManager wedges NetWare nets with the Internet.

A systems integrator uses applets and middleware to provide a help-desk service.

### Data Networks

Speak Up ..... 107  
Running voice over your LAN or WAN can save money.

Novell's Internet/IntranetWare Connection ..... 137  
BorderManager bundles internetwork services for NetWare administrators.

INTERNET/WEB

JBuilder Makes Java a Piece of Cake ..... 34  
Java comes of age with Borland's full-featured development environment.

A New MeetingPoint for Videoconferencing ..... 38  
White Pine's server enables multipoint videoconferencing over IP.

Farming the Web ..... 43  
Here's how to take information gleaned from the Web, shake out the chaff, and store it in the data warehouse.

Smarter and Faster IP Connections ..... 47  
New switch designs help speed the flow of sound and video.

Java Gets Down to Business ..... 87  
Sony Online built a high-traffic Web site with server-side Java components.

CORBA, Java, and the Object Web ..... 95  
Client/server computing on the Web is going to get easier.

Next-Generation News Servers ..... 113  
New NNTP servers make Internet groupware easy.

Web Servers Get Skinny ..... 129  
Need a small-form-factor Web server that's easy to administer and quick to implement?

Novell's Internet/IntranetWare Connection ..... 137  
BorderManager wedges NetWare nets with the Internet.

## INDEX

Accelerated Graphics Port ..... 18  
ATM ..... 47, 58  
Bandwidth accounting ..... 23  
Broadband services ..... 71  
Chips ..... 18, 51  
Client/server ..... 87, 95  
Clustering ..... 26  
CORBA ..... 95  
Data warehousing ..... 43  
Database technology ..... 43, 87, 101, 122  
Digital Subscriber Line ..... 71, 76  
Embedded devices ..... 45  
Ethernet, Gigabit ..... 58, 63  
Frame relay ..... 58, 107  
Graphics ..... 18  
Groupware ..... 113  
Hand-held computers ..... 45  
Internet/Web ..... 38, 43, 58, 87, 95, 107, 113, 129, 137  
Intranets ..... 137  
IP ..... 38, 47, 58, 107  
ISDN ..... 58, 76  
Java ..... 34, 87, 95, 117  
Limbo ..... 53  
Mobile computing ..... 37, 45, 139, 167  
Modems ..... 71, 76  
Networking ..... 19, 23, 26, 47, 58, 63, 71, 76, 87, 95, 107, 129, 137  
News servers ..... 113  
Object databases ..... 101, 122  
Objects ..... 45, 95, 101, 122  
Object Web ..... 95  
Operating systems ..... 32, 45  
Printers, ink-jet ..... 22  
Programming ..... 23, 34, 53, 87, 95, 117  
Publish and subscribe ..... 43  
Remote access ..... 71, 76  
Servers ..... 19, 113, 129  
SQL3 ..... 101  
Systems ..... 18, 33, 133, 167  
Videoconferencing ..... 38  
Web servers ..... 129  
Wireless ..... 71

**Reliability you can depend on**  
Sentinel keys are consistently the industry's most reliable, with performance records far better than any other hardware key.

**A strong commitment to R&D**  
Rainbow invests 11% of its revenue in research and development to make the world's leading protection even better.



**Quick and easy to implement**  
The SentinelWizard™ GUI is an innovative software tool that guides you easily through the implementation process.

**Manage network licenses**  
NetSentinel is the only software protection to undergo rigorous testing by and receive approval from Novell.



**The industry's highest quality**  
Rainbow is the first software protection supplier with ISO certified quality standards.

**Truly transparent protection**  
Designed to perform invisibly to end users, Sentinel automatically identifies system drivers and is transparent to peripherals.



**Superior security and flexibility**  
Proprietary ASIC technology, multiple encryption algorithms in a single key and more make Sentinel the most flexible and secure protection available.

**Compatible with your software**  
Rainbow's partnerships with Apple, Microsoft and IBM ensure the security of your software on any platform today and in the future.



SentinelSuperPro is shown larger than actual size.

# Why Sentinel protects more software than all other dongles combined!

Over 11 million Sentinel® keys protect software worldwide. In fact, 55% of all protected software has a Sentinel key, from Rainbow Technologies.

Sentinel is easy to implement, transparent to your end-users and backed by the world leader. When you need on-time delivery and global support, you need Sentinel.

Only Sentinel gives you leading-edge technology, ISO 9002 certified quality and over 99.99% reliability.

Protect your software investment.

Order a *Sentinel Developer's Kit* now. Each kit comes complete with technical documentation, software drivers, utilities and a Sentinel key.



Call the Rainbow office or distributor nearest you today or visit [www.rainbow.com](http://www.rainbow.com).

**SENTINEL**  
Software Protection  
The "I solution to piracy"

Circle 110 on Inquiry Card.



TEL: (714) 450-7300 • FAX: (714) 450-7450 • EMAIL: [sentinel@rainbow.com](mailto:sentinel@rainbow.com) • FRANCE: (33) 1 41 43 29 00 • GERMANY: (49) 89 32 17 98 0 • U.K.: (44) 1932 579200  
©1997 Rainbow Technologies, Inc. Sentinel, SentinelSuperPro & SentinelWizard are registered trademarks of Rainbow Technologies. All other product names are property of their respective owners.

ALGERIA: AFAK (213) 3 41 22 36  
ARGENTINA: Aqul Aul, S.A. (54) 1 8030536  
AUSTRALIA: LOADPLAN (01) 3 9690 0455  
BELGIUM/LUXEMBURG: (25) 32 9 221 0383  
BRAZIL: MPPS Sistemas Ltda. (55) 21 574 8866  
CHILE: TOPsoft (56) 2 235 4456  
CHINA (East): Shanghai Padong Software Park Electronics Company (86) 21 6417 8626  
CHINA (North): CSES (86) 10 6217 7222 X2404  
CHINA (Southern): Shenzhen Futech Research Co., Ltd. (86) 755 3205906  
COLOMBIA: Construdata (57) 1 622 6011  
CZECH REPUBLIC: ASKON Int'l (420) 211 086 52  
ECUADOR: SOTI LUNO S.A. (593) 4 308251  
EGYPT: ZEDAN-ADS (202) 248 8994  
GREECE: Byte Computer S.A. (301) 924 17 33  
GUATEMALA: Soft Corporation (502) 2 304006  
HONG KONG: AlfaLink Technology Company (852) 2 233 0626  
HUNGARY: Polyware KH (36) 76 481 236  
INDIA: ANC Engineering Co. (91) 11 4615680

INDONESIA: PT. Prompride InfoScan (62) 21 375 166  
IRAN: GAM Electronics (98) 21 87 44 001  
ITALY: BFI IBM XSA SPA (39) 23 36 231  
ITALY: Sistiosimi (39) 30 24 411  
JAPAN: Giken Shoh Co., Ltd. (81) 52 97 6544  
JORDAN: CDG Engineering (962) 68 63 861  
KOREA: Genius Technologies (82) 2 578 3528  
LEBANON: National Group Cons. (961) 1 494317  
MALAYSIA: Eastern Systems Design (M) Sdn Bhd (60) 3 241 1 1188  
MEXICO: Impex Comp., S.A. de C.V. (52) 66 210 291  
NIGERIA: PT. Prompride InfoScan (62) 21 375 166  
NEW ZEALAND: Software Images (64) 9 378 9790  
PERU: OpenSoft (51) 1 224 2125  
PHILIPPINES: Mannasoft Technology Corporation (63) 2 813 4162  
PORTUGAL: COMITTA (351) 1 941 65 07  
RUSSIA: Multisoft Int'l (7 095) 176 35 84  
SAUDI ARABIA: ZEDAN (966) 2 665 1904  
SCANDINAVIA: Perko A/S (47) 2249 1500  
SINGAPORE: Systems Design PTE LTD (65) 747 2266

SOUTH AFRICA: SOFTSECURE (27) 11 887 3943  
SPAIN: MELCCO (34) 3 422 7700  
SWITZERLAND: BIV AG (41) 1 745 92 92  
SWITZERLAND: Sale Computer S.A. (41) 24 425 5386  
TAIWAN: Everline Tech. (886) 2 8208925  
THAILAND: Business Computer Systems Co., Ltd. Int'l (66) 2 319 4451  
TUNISIA: Soft Info Technique (216) 17 19 486  
TURKEY: BIMEKS, Ltd. (902) 16 34 81 508  
VENEZUELA: IRFM Users (58) 2 261 4282

**EDITOR IN CHIEF**

Mark Schlack  
Lexington, MA, 617-860-6827  
mschlack@bix.com

*Editorial Assistant:* Chrystie Kilbourn-Terry

Lexington, MA, 617-860-6294, christie\_terry@mgh.com

**EDITORIAL****EXECUTIVE EDITORS**

*International:* Rich Friedman  
Peterborough, NH, 603-924-2523  
rfriedman@bix.com

*New Media:* Jon Udell  
Peterborough, NH, 603-924-2622  
judell@bix.com

**MANAGING EDITOR**

Jenny Donelan  
Peterborough, NH, 603-924-2511  
jdonelan@bix.com

**WEST COAST**

*Bureau Chief/Features Editor:* John Montgomery  
San Mateo, CA, 650-513-6809  
jmonggomery@bix.com

**NEWS**

*News Editor:* David L. Andrews  
Lexington, MA, 617-860-6296  
dave.news@bix.com

*Senior Editor:* Rainer Mauth  
Frankfurt, Germany, +49 69 5801 123  
rmauth@bix.com

*Associate News Editor:* Jason Krause  
San Mateo, CA, 650-513-6931  
jkrause@bix.com

**REVIEWS**

*Director:* David Essex  
Lexington, MA, 617-860-6299  
dessex@bix.com

*Technical Manager, BYTE Lab:* Al Gallant  
Lexington, MA, 617-860-6389  
agallant@bix.com

*Technical Editor:* Michelle Campanale  
San Mateo, CA, 650-513-6810  
mcampagne@bix.com

*Technical Editor:* Russell Kay  
Lexington, MA, 617-860-6207  
russellk@bix.com

*Technical Editor:* Pete Loshin  
Lexington, MA, 617-860-6830  
ploshin@bix.com

**FEATURES**

*Senior Technical Editor at Large:* Tom Thompson  
Lexington, MA, 617-860-6302  
tom\_thompson@bix.com

**Senior Technical Editor:**

Edmund X. DeJesus  
Lexington, MA, 617-860-6959  
edjesus@bix.com

*Senior Editor:* Tom Halffhill  
San Mateo, CA, 650-513-6915  
thalffhill@bix.com

*Senior Editor:* Scott Mace  
San Mateo, CA, 650-513-6833  
scott\_mace@bix.com

**NEW MEDIA**

*Production Associate:* Joy-Lyn S. Blake  
*Web Site Applications Developer:* Dave Rowell

**SENIOR RESEARCHER**

Rowland Aertker  
raertker@bix.com

**ASSOCIATE TECHNICAL EDITORS**

Dennis Barker, Cathy Kingery,  
Warren Williamson

**PRODUCTION**

*Production Coordinator:* James J. Perry

**EDITORIAL ASSOCIATE**

Linda Higgins  
Peterborough, NH, 603-924-2689  
lindahiggins@bix.com

**SENIOR CONTRIBUTING EDITOR**

Jerry Pournelle  
jerryp@bix.com

**CONTRIBUTING EDITORS**

Dick Pountain, Udo Flohr,  
Rick Grehn

**CONSULTING EDITORS**

Stephen Apiki, Raymond GA Côté,  
Alan Joch, Stan Miastkowski,  
Barry Nance, Roberta Pournelle,  
Peter Wayner

**DESIGN**

*Design Director:* Charles Dixon III  
*Associate Design Director/Design & Photography:* Sharon Price

*Associate Design Director/Graphics:* Joseph A. Gallagher

*Designers:* Cindy Sands,  
Donna Sweeney

**VICE PRESIDENT/PUBLISHER**

Kevin McPherson  
Lexington, MA, 617-860-6020  
kmcphers@mcgraw-hill.com

*Publisher's Assistant:* Lois Beninati  
Lexington, MA, 617-860-6126

**ASSOCIATE PUBLISHER**

Michael P. Walsh  
Lexington, MA, 617-860-6714  
mike\_walsh@mcgraw-hill.com

**DOMESTIC AND INTERNATIONAL ADVERTISING STAFF**

See listing on page 165.

**Sales Support:**

Kathi Andrick 614-899-4909

**REPRINT SALES**

Susan Monkton 603-924-2618

**LICENSING**

*Copyrights Manager:* Faith A. Ellington 603-924-2525

**FINANCE AND OPERATIONS**

*Director:* Jack Casey

**FINANCE**

*Senior Financial Analyst:* Charles Barber

*Manager, Information Systems & Technology:* Peggy Dunham

*Systems Administrator:* Mike Nagle

*Junior Financial Analyst:* Jason Wanatik

**CIRCULATION**

*Newsstand Manager:* Vicki Weston

*Circulation Assistant:* Jill Wood

*Back Issues:* 603-924-9281  
Fax: 603-924-2683

**ADMINISTRATION**

*Human Resources Administrator:* Pat Burke

## HOW TO CONTACT THE EDITORS

We welcome your questions, comments, complaints, kudos, and submissions.

**MAIN OFFICE:** 29 Hartwell Ave., Lexington, MA 02173, (617) 860-6336.

**Peterborough:** One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281.

**San Mateo:** 1900 O'Farrell St. #200, San Mateo, CA 94403, (650) 513-6912.

**GERMANY/EUROPE:** Emi von Behring Strasse 2, 60439 Frankfurt, Germany, +49 69 5801 123.

**ELECTRONIC MAIL:** On BIX, send to "editors." All BYTE editors and columnists also have individual mailboxes on BIX for easy access.

**MCI:** 250-0135 BYTE Magazine. Many editors also have individual MCI addresses in their own names.

**OTHERS:** Many editors are also reachable through AppleLink, CompuServe, and numerous other services.

**WEB:** <http://www.byte.com>

**U.S. fax:** Editorial: (617) 860-6522

Advertising: (603) 924-7507

**U.K. fax:** +44 171 495 6734

**SUBMISSIONS:**

**Authors:** We welcome article proposals and submissions. Unacceptable manuscripts will be returned if accompanied by sufficient return postage. Not responsible for lost manuscripts or photos.

**Vendors:** We welcome news of your new products; please call the News department or the Reviews department at the earliest possible date. We cannot be responsible for unsolicited product samples.

**ARTICLE REPRINTS:**

For price quotations on customized reprints of BYTE articles, contact Susan Monkton, reprints manager, at (603) 924-2618. (Minimum quantity: 500.)

**SUBSCRIPTION CUSTOMER SERVICE**

**Inside U.S., (800) 232-BYTE; outside U.S., +609 426 7676. E-mail-based customer service: mpctsvc@mcgraw-hill.com; Web-based customer service: <http://www.byte.com/admin/mpaddch.htm>. International subscribers may also contact our international customer service in Galway, Ireland, by calling +353 91 752792 or via fax: +353 91 752793. For a new subscription, (800) 257-9402 U.S. only, E-mail: [mporders@mcgraw-hill.com](mailto:mporders@mcgraw-hill.com) or write to BYTE Subscription Dept., P.O. Box 555, Hightstown, NJ 08520. Subscriptions are \$24.95 for one year, \$49.90 for two years, and \$74.85 for three years in the U.S. and its possessions. In Canada and Mexico, \$34.95 for one year, \$64.95 for two years, \$87.95 for three years. Internationally, US\$60.00 for fast surface delivery, US\$85.00 for air delivery. Single-copy price is \$3.95 in the U.S. and its possessions, \$4.95 in Canada. Foreign subscriptions and sales should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue.**

**PHOTOCOPY PERMISSION:**

Where necessary, permission is granted by the copyright owner for those registered with the Copyright Clearance Center (CCC), 222 Rosewood Dr., Danvers, MA 01923, to photocopy any article herein for personal or internal reference use only for the flat fee of \$1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 222 Rosewood Dr., Danvers, MA 01923. Specify ISSN 0360-5280, \$1.50. Copying done for other than personal or internal reference use without the permission of The McGraw-Hill Companies, Inc., is prohibited. Requests for special permission or bulk orders should be addressed to Faith Ellington, copyrights manager, (603) 924-2525. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London, WC1R 4EJ, U.K.

**BYTE**

A Division of The McGraw-Hill Companies

Copyright © 1997 by The McGraw-Hill Companies, Inc. All rights reserved. BYTE and **BYTE** are registered trademarks of The McGraw-Hill Companies, Inc. Trademark registered in the United States Patent and Trademark Office.

 Member Audit Bureau of Circulation

## BIX GLOBAL CONFERENCING SYSTEM, AN ON-LINE COMMUNITY

**ACTING MANAGING EDITOR**

Peter Olson

**EXCHANGE EDITORS**

*Amiga Exchange:* Joanne Dow  
*Entertainment and Leisure Exchange:* Rich Taylor  
*IBM Exchange:* Barry Nance  
*Programmers Exchange:* Bill Nicholls  
*Professionals Exchange:* David Reed  
*Tel Jerry Exchange:* Jerry Pournelle  
*Windows Exchange:* Karen Kenworthy  
*Writers Exchange:* Wayne Rash Jr.  
*Macintosh and Other Exchanges:* At Large

**INFORMATION ENGINEER**

Peter Olson

BIX is the BIX Information Exchange, your best source for technical advice. BIX is owned and operated by Delphi Internet Services Corporation. Find us on the Web at <http://www.bix.com/> (all browsers are welcome). E-mail our auto-responder at [info@bix.com](mailto:info@bix.com) or fax us at (617) 441-4902. Dial us by modem at (800) 695-4882 or (617) 492-8300 (V.34, 28.8 Kbps). Telnet to x25.bix.com or call us (voice) at (800) 695-4775 or (617) 354-4137. Connect via packet networks to host BIX. Look in the last few pages of this magazine for our advertisement.

**MEMBER SERVICES MANAGER**

Chuck Greenslit

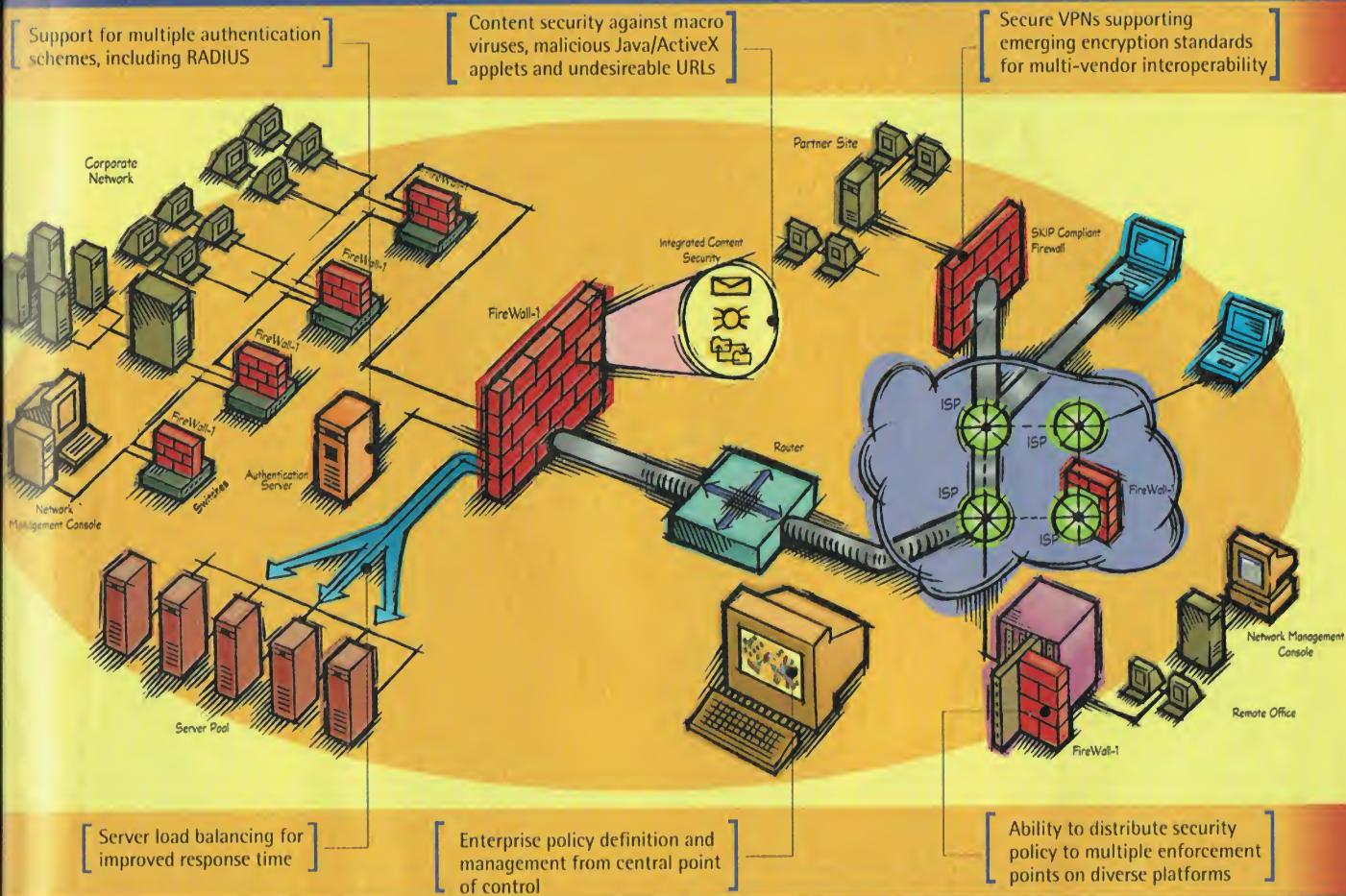
**OFFICERS OF THE MCGRAW-HILL COMPANIES:**

*Chairman and Chief Executive Officer:* Joseph L. Dionne; *President and Chief Operating Officer:* Harold W. McGraw III; *Senior Vice President and General Counsel:* Kenneth M. Vittor; *Executive Vice President and Chief Financial Officer:* Robert J. Bahash; *Senior Vice President, Treasury Operations:* Frank D. Penglase; *President, Information Services Group:* Michael K. Hehir; *Group Vice President, Information Technology and Communications Group:* Kevin C. Harold.

# Enterprise Security.

Your requirements are real. So is our solution.

Version 3.0  
Now Shipping



Presenting Check Point FireWall-1, the only true enterprise security solution available today. Right now. When you need it most.

You're demanding more from your network every day. To keep pace, your network security solution must reach new heights too.

Check Point FireWall-1 provides the solution. A complete application suite to meet all your enterprise security requirements. Corporate intranets and extranets. VPNs. Internet commerce. Anywhere and everywhere you want to take your network.

FireWall-1 Security Policy							
No.	Source	Destination	Service	Action	Track	Install On	
1	Any	Web_Server_Pool	Http	accept	Long	Gateway	
2	Sales@Any	SQL_Server	sqlnet2	User Auth	Long	Gateway	
3	Network-NY	Network-Tokyo	Network-NY	Encrypted_Services	Encrypt	Account	
4	Trusted_Sites	Network-NY	Http>Http_JAVA_ActiveX	accept	Short	Gateway	
5	Network-NY	NY_Router	new_Jetmail	reject	ShpTrap	NY-Router	
6	Any	Any	Any	drop	Alert	Tokyo-Router	

With FireWall-1, you can define a single, enterprise-wide security policy that integrates multiple applications, is distributed to multiple enforcement points and is centrally managed.

The entire product suite is unified by Check Point's OPSEC [Open Platform for Secure Enterprise Connectivity] policy management framework. Third-party security applications plug into OPSEC for an end-to-end solution that is centrally configured and managed.

For more information and to register for your FREE FireWall-1 demo CD, visit our Web site at [www.checkpoint.com](http://www.checkpoint.com).

CHECK POINT®

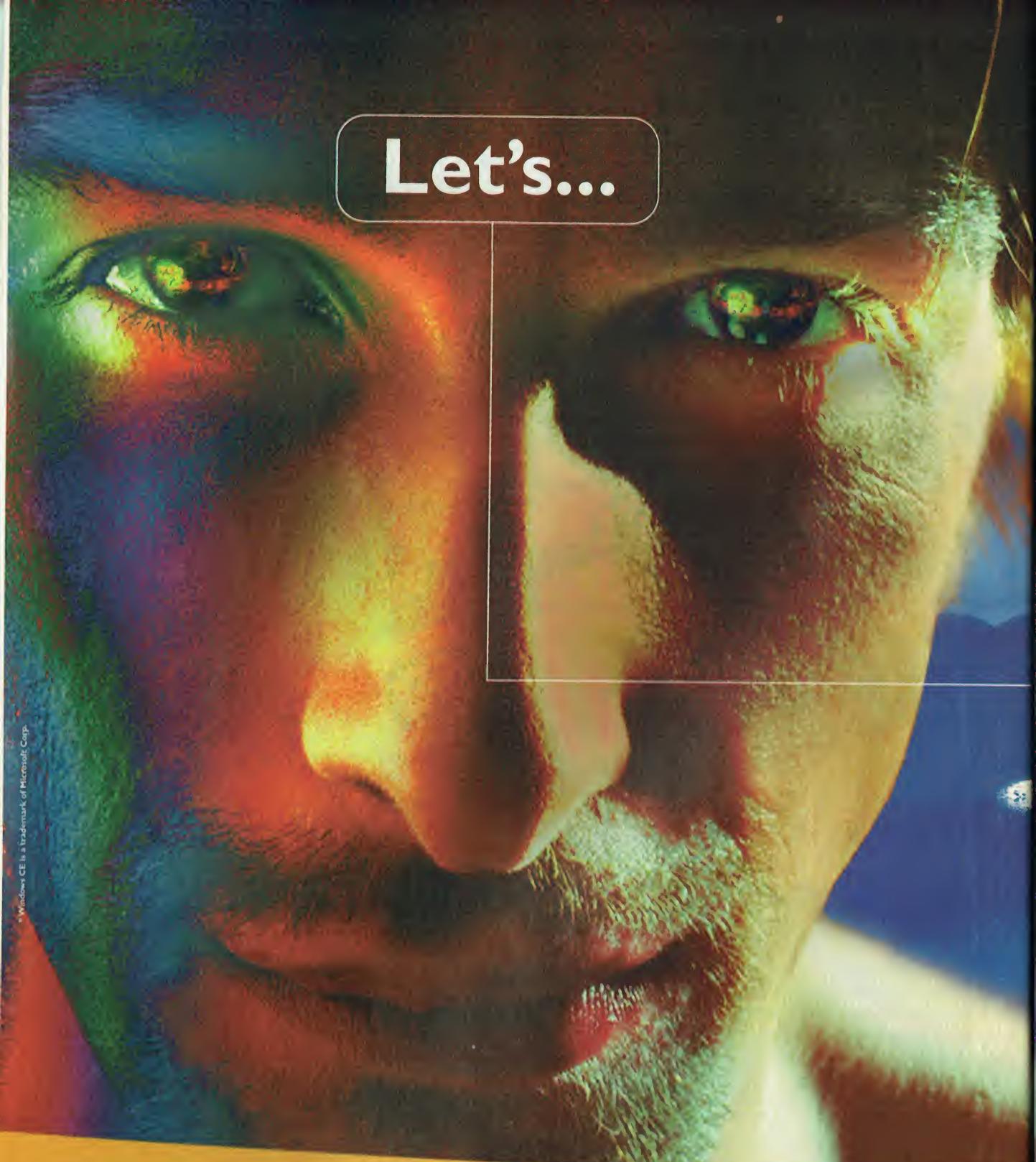
Software Technologies Ltd.



**FireWall-1**

Circle 457 on Inquiry Card.

List of Check Point Worldwide Distributors and Resellers <http://www.checkpoint.com/partners/index.html>



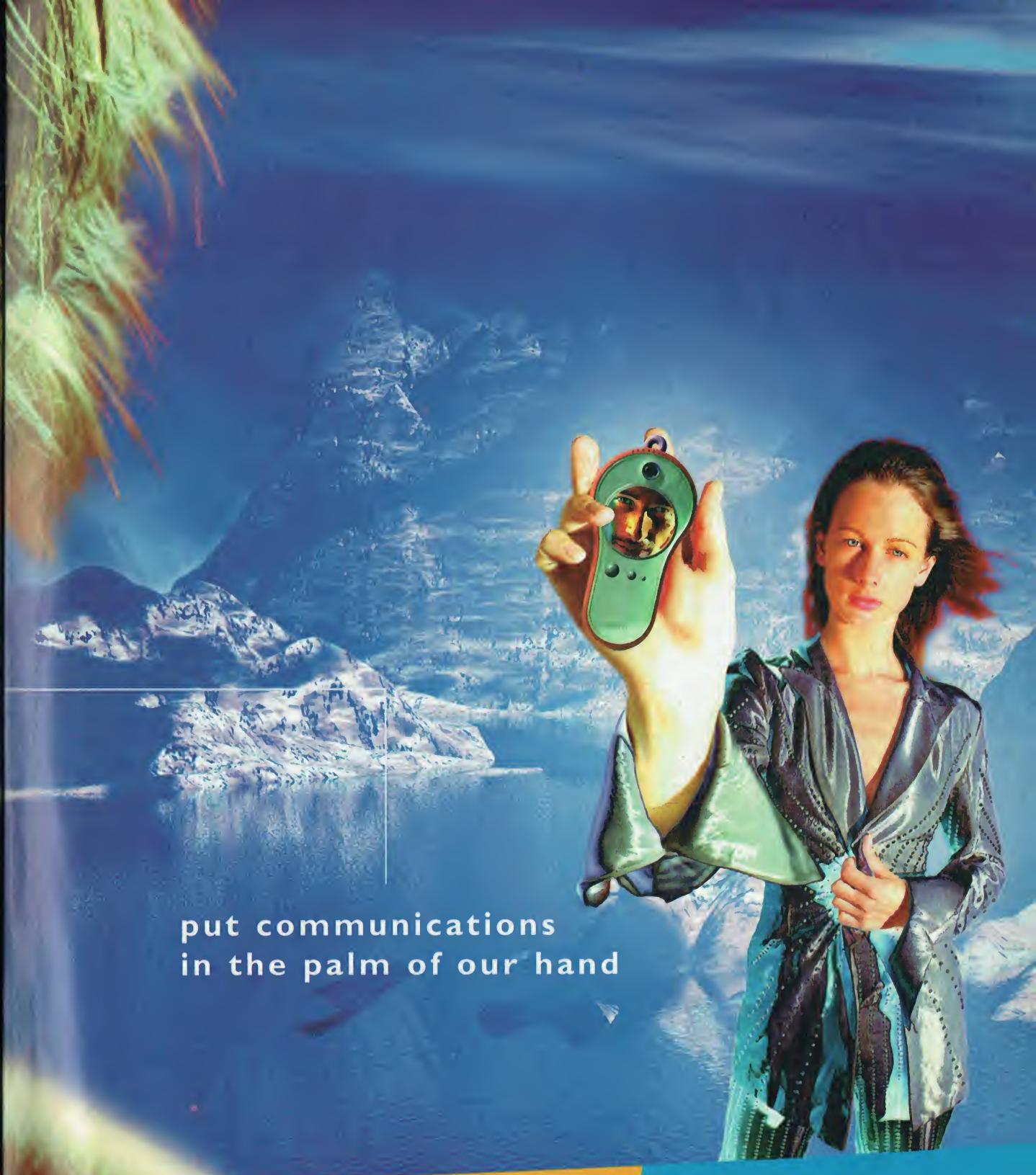
# Let's...

**Think small and the future's in your**

**hands.** Because tomorrow small things will make a big difference. Hand-held communications are bringing us new freedom. To be more productive, wherever work may take us. To enrich our personal lives too, by keeping us closer to people we care about. If that's the highway your imagination's taking, you're in good company. Because at



**Philips Semiconductors** we're well down the road, with off-the-shelf chipsets that can cut product development times and risk dramatically. Like the TwoChipPIC, a powerful MIPS based solution that's the most integrated option for PICs/ PDAs and related devices - complete with fax/data modem software to reduce system costs. And a single chip solution, the OneChipPDA, that's ideal for advanced organizers. Plus reference designs that will help turn your ideas into



put communications  
in the palm of our hand

products faster. Add our support for major PIC and PDA operating systems, such as Microsoft's new Windows CE\*, as well as our related technologies - GPS, wireless communications - and you can imagine the possibilities. So see the future today at [www.semiconductors.philips.com](http://www.semiconductors.philips.com). Because together we can get in touch with tomorrow. USA tel. +1-800-447-1500, ext. 1314. Europe fax. +31-10-284-3181, quote "cm". Asia fax. +852-2811-9173, quote "BI".

Circle 468 on Inquiry Card (RESELLERS: 469).



**PHILIPS**

*Let's make things better.*

# Editorial

## Industry Warfare: What's Up with That?

*Business is booming, but so are the cannons of competition.*

**T**he Mars Pathfinder mission produced over 400 million hits at related Web sites in just the first week. If you were up on the Net in the first hours after the landing, you were probably as bemused as I was. Far from being prepared for this onslaught, a lot of the non-NASA sites that traffic in science/science fiction were totally absorbed by the 50th anniversary of the Roswell, New Mexico, incident. Pseudoscience and dubious history outshining the real thing? Guess again.

Maybe the smart guys ain't always so smart. That's the theme of the computer industry recently. Look at the behavior of some of the major players. The market is booming, but rather than take a "rising tide floats all boats" attitude, they're wasting time and money on infighting. What's up with that?

The increasingly contentious Windows and Java camps are a perfect example. They're in a fierce war. The first casualty: openness. The straw man argument of the year is "Standards bodies take too long. Customers want us to get products to market sooner."

Hello! Has anyone noticed this Internet thing? Produced by standards bodies, wasn't it? Both the Internet community and the communications community have known for a long time how to work with standards bodies, anticipate them, get products to market that embody draft standards and are upgradable, and assure users that the road ahead is not fraught with dead ends. Time for the software industry to place more emphasis on that process and less on shipping beta software as finished products.

The fact of the matter is that neither Windows nor Java is remotely close to being open. That doesn't make them bad, but until Microsoft and Sun turn tech-

nologies like ActiveX and Java over to committees that can really craft the technologies' futures in a consensual manner, I won't call any of them open. Popular, available, inexpensive, and useful—even extensible—is not the same as open.

How long can Microsoft say that "Java is a language, Windows is the platform" without becoming irrelevant to a significant portion of its customers who persist in multiplatform computing? Doesn't the company remember when Windows was as immature as Java is now and people still chose it over their installed systems? And the Java crowd is going to have to grow out of its puerile "pure Java" stance to embrace living legacies like Windows.

And what's up with Intel? Here at BYTE we're watching the Slot 1/Socket 7 controversy very closely. The historic, relative flexibility of the Intel architecture has certainly helped Intel become the



specialized platforms: Web TVs, network computers, PDAs, desktops, uniprocessor servers, quadprocessor servers, and so on. The more Intel owns of the PC architecture, the less able it will be to serve that diversity of needs. If the Sequents and Corollaries of the world

### Maybe the smart guys ain't always so smart. That's the theme of the computer industry recently.

dominant force it is. Now, Intel seems bent on dictating not just processor architecture but computer architecture as well.

It's a curious tack to take. A few years ago, we all debated endlessly whether RISC would overtake CISC. That war is over. Intel has brought RISC concepts like pipelining into its architecture. That, and the continued preponderance of integer-based computing, has kept the floating-point kings of the RISC world at bay. If anything, the dual-processor Intel machine running NT has become a very solid alternative to many RISC/Unix workstations. Is Intel that worried about AMD and Cyrix?

We're in the midst of a pendulum swing away from general-purpose computers and toward a greater number of

had not pioneered symmetric multiprocessing with the 486, would Intel be in a position to turn SMP into a commodity today? No way.

What about emerging technologies like hand-helds or wearable computers? Are they to be stuck with a one-size-fits-all technology like the Pentium II single-edge cartridge? Or will other chip makers fill their needs? Probably not what Intel had in mind, but it could be the outcome.

*Mark Schlack*

**Mark Schlack, Editor in Chief**  
[mschlack@bix.com](mailto:mschlack@bix.com)

# LAN to the World in Minutes with Compex Passage Series ISDN Routers!

**WORLD-WIDE WAIT NO MORE!**

Compex Passage Series ISDN Routers connect directly to your existing Ethernet hub for fast, secure, easy and affordable Internet and WAN access. Designed for SOHO or small/medium sized remote offices, Passage Series routers feature:

**Simple installation and configuration - TAKES ONLY MINUTES TO SET-UP!** As easy as connecting to the Internet via modem.

**Single dynamic IP address with Ports Address Translation (PAT)** - allows up to 254 users simultaneous Internet access using one IP address.

**Security** - built-in firewall, data encryption and authentication.

**STAC Data Compression** - enables greater throughput accessing the Internet.

**DHCP Server** - automatically assigns addresses to devices on the private LAN.

**MultiLink PPP** - by load sharing or overflow control for increased bandwidth on demand.

**Several Models Available** - capable of supporting analog modems, T1/E1, Frame Relay and ADSL.

**Support** - backed by a worldwide company with over 10 years experience.



For more information on the Compex Passage Series ISDN Routers or our complete line of Ethernet networking products, contact Compex or leading distributors throughout the world now!

[http:// www.cpx.com](http://www.cpx.com).

U.S.A.

**COMPEX, Inc.**

4051 E. La Palma, Anaheim, CA. 92807 U.S.A.  
Tel: (714) 630-7302 • Fax: (714) 630-6521

GERMANY

**ReadyLINK Networktechnology GmbH**  
Albert-Einstein-Strabe 42, 63322 Rodemark  
Tel: (49) 6074 98017 • Fax: (49) 6074 90668

SINGAPORE

**COMPEX Systems Pte Ltd**  
135 Joo Seng Road, #08-01,  
PM Industrial Building, Singapore 368363  
Tel: (65) 280 9947 • Fax: (65) 280 9947



*Networks that work!*

Circle 431 on Inquiry Card (RESELLERS: 432)



## Thanks for Not Being Pushy

How refreshing! You actually have the audacity to resist the rampant bandwagon-jumping that threatens to strangle diversity out of the computer industry. I'm talking about "The Pull of Push" (August), in which you call "push" technology what it really is: a useless moniker cooked up by publicists and ad men in the unending quest to attract the all-important consumer dollar.

The pace of change in the computer industry is breathtakingly rapid enough when driven by the one thing that will help us all: technology that makes life easier and more productive. When the widening acceptance and use of computers spurs product creation and promotion through the implementation of "TV think," we are all threatened with unnecessary product obsolescence and the ensuing costs in dollars and loss of productivity.

Thank you for being the first to resist this silly trend. Maybe clear examination of this subject will keep push from becoming the latest addition to '90s-speak.

**Michael H. (Ned) Franz**  
University of Arizona  
Steward Observatory Mirror Lab  
[nfranz@as.arizona.edu](mailto:nfranz@as.arizona.edu)

## CDPD in the Real World

In "Air War" (Special Report, August), Marty Jerome suggests that CDPD

is a standardized and useable product. While CDPD is available and being employed by some wireless users, many of the nation's largest wireless users have shied away from it. On two occasions I have been involved in an evaluation of CDPD technology. In both tests it came up lacking.

There were two primary concerns with CDPD. First, the suggestion that CDPD works on channels that the voice system is not using. This is technically true, but in a metropolitan environment where cellular traffic is heaviest, most CDPD vendors have supplied dedicated channels to CDPD traffic, and the channel-hopping mode has proven quite difficult to use. Without the overhead of adding TCP to our IP packets, it was almost impossible to get any data through reliably.

Second, the system claims to have coverage that is not really available. Not all cell sites in a given metropolitan area are equipped with CDPD base stations, nor all repeaters. In fringe and rural areas, the coverage is even worse. For our circumstances, with thousands of mobile units using wireless every day, CDPD was not a viable solution.

**Chris Chappell**  
[iim1cje@smtguy.roadnet.ups.com](mailto:iim1cje@smtguy.roadnet.ups.com)

## Digital Mud, 1833

Your Future Watch item ("Digital Ink Gives New



Meaning to Paper Recycling," August Bits) suggests that the time may come when readers can receive each new issue of their newspaper printed on the same sheet of paper as was the previous issue. That time may have come 164 years ago, if we can believe a note in the Philadelphia *Saturday Courier* of December 21, 1833.

"We heard lately," the note reported, "of a newspaper establishment in Indiana, somewhat novel in character. A printer has provided himself with a supply of wooden type[s], and having set up the form of his paper, each of his subscribers furnishes him with a piece of

linen or muslin of the proper size, whereupon the printer inks his type with swamp mud, and takes the impression upon the cloth for each patron, who receives his Paper on Saturday, and after reading it, has the cloth washed in the nearest 'crick' and sent back in time for the next impression."

**David Kaser**  
Distinguished professor emeritus  
Indiana University  
School of Library and  
Information Science  
[iuslis@indiana.edu](mailto:iuslis@indiana.edu)

## Stop Making Us Feel Stupid

Jerry Pournelle, whose column I enjoy, says that he was made to feel stupid by not knowing how to prevent DOS-based games from blowing up in Windows 95 (Chaos Manor, August). This is a very computer-literate person who was made to feel stupid by something that is supposed to provide entertainment. Imagine how John Q. Average-Computer-User feels! I have shared Jerry's frustrations, and I have been

### HOW TO CONTACT US

#### ON THE WEB

Visit The BYTE Site!  
Search our archives.  
Download articles. See  
industry press releases.  
Join on-line conferences  
with other BYTE  
readers! See [http://](http://www.byte.com)  
[www.byte.com](http://www.byte.com).

#### BY FAX

617-860-6522

#### BY E-MAIL

Address letters to  
editors@bix.com. To  
reach individual  
BYTE editors, see The  
BYTE Site on the Web  
for a directory. Letters  
may be edited for  
publication.

#### BY POST

Editors, BYTE,  
29 Hartwell Ave.,  
Lexington, MA  
02173

#### SUBSCRIPTION CUSTOMER SERVICE

U.S. only: 800-232-  
2983; international:  
609-426-7676; or see  
<http://www.byte.com/>  
[admin/mpcstsv.htm](http://www.byte.com/).

For advertising and  
other noneditorial  
contacts, see pages 165  
or 6 or click on the  
Information link on  
The BYTE Site.

involved with computers for 30 years. I finally gave up and threw out my DOS-based games after trying special boot disks and all the other suggested remedies.

The software producers have lost sight of the fact that their ultimate market potential depends not only on super graphics but also on simplicity and reliability. Inadequate manuals (forget on-line help) and nonexistent technical support are driving customers away. Developers are struggling with the interactions of layers of gigabyte software. Try to explain the advantages of spending megabucks on three-tier intranet data-warehousing systems to a CEO who has misgivings about entrusting his corporate and personal futures to a technology that cannot even run a game.

If the software industry sees its future in ever-larger, more complex, more expensive reissues of current products, it is wrong. The network computer may not be the answer, but Oracle's Larry Ellison is dead on target when he talks about the need for simplicity. Then nobody will feel stupid.

**Kim Bassett**  
KimBassett@compuserve.com

## NT's Not Proprietary? Ha!

In response to a letter on the subject of NT and Unix comparisons (Inbox, July), contributor Robert L. Hummel quoted "a significant part of the market" as saying "NT boxes ... don't lock us into a single-vendor hardware solution or become obsolete when the vendor wants a new revenue stream."

Excuse me, but if you substitute "software" for "hardware" in the above state-

ment, you will find yourself describing Microsoft, whose power in the market is based on being a single-vendor software solution with a deadlock on its customers. Yes, RISC boxes tend to be proprietary, but so is Microsoft's software, a fact that the PC press seems to keep forgetting.

All commercial computing is proprietary; that's the nature of the beast. Please don't make yourselves look unaware of this simple fact by throwing "single vendor" barbs at one camp in defense of another camp. You should know better.

**Michael Rasmussen**  
Systems technologist, Bermuda Microsystems  
Hamilton, Bermuda  
miker@bdamicro.com

## Showdown at the MMX Corral

"MMX Power for Desktop PCs" (Hardware Lab Report, July) featured a small review of AMD's K6 CPU. What a disappointment. I expected a true objective analysis of Intel vs. AMD. And in the end you say that the AMD might be a strong competitor. Might?!? From what I've read and discussed, AMD beats Intel hands-down (including the Pentium II): 233-MHz vs. 233-MHz, AMD wins; 200 vs. 200, AMD wins. Of course, this is all based upon a system being set up correctly.

**Josh Javage**  
javage@aol.com

We said further on in that sidebar that as certain performance problems relating to chip sets and BIOSes are eliminated, "the K6 will be a potent competitor to the Intel CPUs." Based on our testing, we conclude that, in general, the K6 competes

with the Pentium II almost clock-for-clock in integer performance but definitely lags behind in FP and MMX performance. As we said in the Lab Report, the K6 box we tested—XI Computer's Xi K200 MTower—"turned in a composite performance score



nearly identical to that of its MMX Pentium counterparts." (Also check out our June issue, page 26.) But AMD is slightly behind Intel in offering top clock speeds: The Pentium II is available (albeit in very small quantities at very high prices) at 300 MHz, while the K6 currently peaks at 233 MHz. AMD says it will have a 300-MHz K6 by the end of the year. Intel might be at 350 to 400 MHz by then. So Intel has about a six-month lead in highest clock speeds.

—Editors

## IBM Channels and I/O Processors

Although I realize that Tom Thompson's article "I<sub>2</sub>O Beats I/O Bottlenecks" (August) addresses bus-based machines, and that Mr. Thompson is speaking of lower-end PC servers, nevertheless his description of the IOP (I/O processor) is almost exactly the description of I/O "channels" on the much-maligned IBM mainframes. IBM recognized the importance of such an I/O subsystem many years ago.

Mr. Thompson might have given them passing credit. **Warner Mach**  
73700.2246@compuserve.com

## MessagePad Maligned?

Come on, guys. Your August Lab Report ("Hand-Helds Get Serious," by Michelle Campanale) wasn't a fair, accurate article on handheld computers, was it? Let's check the facts on the Newton MessagePad 2000 you did such a great job of maligning.

Spreadsheet? Yes, there is. Pager? A PC Card pager has been available for several years. Expense filer? Lots of freeware programs are available as extensions to its Notepad. Modem? A 28.8-Kbps PC Card modem is available. Regarding the external keyboard: Yeah, it's big, and that's good because you can actually use it (unlike those laughable CE keyboards). And how about the quick on-screen keyboard? A MessagePad 2000 is a great substitute for a heavy, slow-booting laptop, especially on a business trip. Oh yeah, and here's another big mistake. You say the MessagePad is "proprietary." Last time I checked, Newton OS was running on platforms from a number of different manufacturers.

**Paul C. Smith**  
TetraInfo@aol.com

While the Newton OS might be available on hardware from manufacturers besides Apple, none of those models met the stated criteria for our review. First of all, they had to be available. Digital Ocean, for example, has announced a Newton-based smart phone and a pager product, but neither was on the market. Harris has an

# Your Computer Guy Will Hug You. Your Bookkeeper May Kiss You.



## Save \$1,500 On The ServerSuite Designed Exclusively For Small Business.

Cheyenne® ServerSuite™ 3.0 includes three award-winning, industry-leading products that deliver a turnkey solution for all your critical server needs: storage management, anti-virus and fax communications. And for a truly affordable price. The \$3995 suggested retail price represents a savings of more than 60% if each product were purchased separately.

ARCserve®, Novell's preferred storage management solution, is the industry's best-selling data backup and restore product. It gives you total protection for all of your critical data.

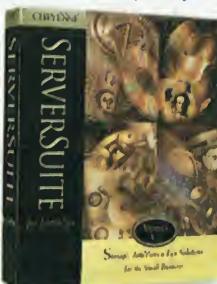
InocuLAN®, Novell's preferred anti-virus solution, is the best anti-virus software you can buy. It offers the most advanced and comprehensive virus protection for your entire network — server and workstations.

FAXserve™, Novell's recommended fax solution, eliminates the

need for paper faxes. With FAXserve, there's no more standing at the fax machine, employees can fax right from their desktop computer maximizing productivity and ensuring privacy. All three of these outstanding products will save you time, money and frustration.

Call today and find out how ServerSuite can help your small business. And if anybody gets too close, tell them a simple thank you will do.

**Call 1-800-991-4438 For A Free Trial  
Or Visit Us At [www.cheyenne.com/adver1/ss3](http://www.cheyenne.com/adver1/ss3)**



**ServerSuite  
for NetWare includes:**  
▪ ARCserve  
▪ InocuLAN  
▪ FAXserve

**COMPUTER  
ASSOCIATES**  
Software superior by design.

# Visual Internet Toolkits

Want to build applications for the Net?



## Share in the experience:

"We conducted a test session to compare the performance of similar products, and Distinct's product was better." -Dr. Shyam Sunder, Carnegie Mellon University

"Distinct provided a Telnet OCX/VBX that saved up to 6 months of development time and reduced the overall development cost."

-Paul Calboun, Tandem Computers

"The Distinct package includes custom controls that are easy to use, reliable, and perform well."

-Darwin Hattheway, 3M Company

"By using Distinct, CRM saved a lot of time and money and provided great solutions for challenging tasks." -William Gutekunst, CRM Technologies

"It is not often, in today's market, that you can find companies that want to find the solution to a customer's problem, no questions asked. Thank you." -Scott G. Phillips, NTN Communications, Inc.



Distinct provides the most comprehensive, robust and market tested Internet and Intranet components available in the world. Just plug them into your applications and deliver solid products fast and on schedule. Every time.



*The world leader in Internet development tools.*

<http://www.distinct.com>  
 sales@distinct.com  
 Phone: 1-408-366-8933  
 Fax: 1-408-366-0153

Software box required for redistribution. Some products may not be available in all forms. Distinct is a registered trademark of Distinct Corporation. Network, Windows, Windows NT, and the Windows logo are registered trademarks of Microsoft Corporation. Copyright Distinct Corporation, 1997.

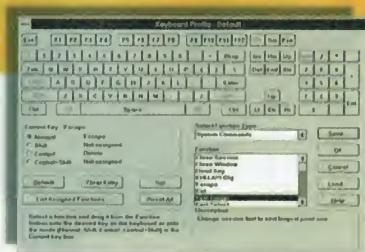
## Distinct IntelliTerm™

Integrated Terminal Emulator for DEC and IBM® Systems



### Highlights:

- TN3270 Emulation-Models 2,3,4 and 5 (for IBM Mainframes)
- 3179G Vector Graphics & 3279S3G
- TN5250 (24x80, 27x132) (for AS/400)
- VT52, VT100, VT220, VT320 & VT420 emulation (for DEC and UNIX Systems)
- Customizable keyboard layouts, poppads and session profiles
- VBA™ Advanced Scripting Language
- DDE, HLLAPI, EHLLAPI, WinHLLAPI and Visual Basic™
- Available for Windows 3.11, Windows 95 and Windows NT



Free  
 Evaluation Copy  
 Available at...



**distinct**  
*The world leader in Internet development tools.*

408.366.8933  
 WWW: <http://www.distinct.com>  
 Fax: 408.366.0153  
 E-mail: [bytemag@distinct.com](mailto:bytemag@distinct.com)  
 Fastfacts: 408.366.2101

Software box required for redistribution. Some products may not be available in all forms. Distinct is a registered trademark of Distinct Corporation. Copyright Distinct Corporation, 1997.

# inbox

industrial hand-held for telecom technicians, but we focused our review on units for general-purpose users. So that the MessagePad would meet our price cap, we didn't include items that were not part of its standard configuration. Likewise, we didn't list the add-ons for any of the other hand-holds.

—Michelle Campanale

July Hardware Lab Report on MMX machines was labeled misleadingly. It relates each system's price to its overall rating, not just raw performance. We apologize for any confusion.

For the sidebar "Kill Two Birds with One Phone" (on page 123) in the August Hardware Lab Report, we were given incorrect information about the weight of the Nokia Communicator. It does not weigh a tad over 2 pounds. It actually weighs .875 pound, or 397 grams.

## FIXES

The "Price vs. Performance" graph (on page 111) of the

## COMING UP IN NOVEMBER

### COVER STORY

## Satellite Networks

We'll explain how they work, report on who's using them, and forecast the future of this technology.

### FEATURES

## Intel Sockets and Slots

Intel's Single Edge Contact (SEC) cartridge could backfire: AMD, Cyrix, core logic vendors, and motherboard makers locked out by SEC might band together.

## NT Security

Ten steps to flexible lockdown of Windows NT systems.

### REVIEWS

## Virtual Private Networks

Private, worldwide networks running over IP might be this year's most intriguing use of Internet technology. The BYTE Lab tests VPNs and products that get you there from here.

## Personal Protection

Personal encryption software is a must for security-conscious Web users. We test the leading packages. Plus: How to choose digital certificate software and services.

## SuiteSpot or IIS?

For more and more Webmasters, the deployment decision comes down to Netscape or Microsoft. With this comparative review, we'll help you decide.

### CORE

## Inside the Virtual PC

Connectix has developed software that enables Macs to run Windows programs. The core of the Virtual PC is code that translates Pentium instructions into PowerPC instructions. We'll tell you how this software PC does its tricks.

# Thinking Smart Cards?

## Think ASE.

New!  
ASE-II™ - Next  
Generation ASE



**In the new world of smart cards, ASE is all you need to develop and deploy Smart Card applications.**

- **ASEDrive Pro™**, the most versatile smart card drive
- Well connected:** PC Internal and External, serial and parallel ports
- Secure:** Second card slot or SIM socket for authentication and security
- Fast:** PC-drive communication speed up to 115 Kbps. Cards support up to 78K
- On time:** Real Time Clock for e-commerce or digital signature
- Knows its cards:** Multi card protocol T=0; T=1; T=14; Memory: I<sup>2</sup>C, XI<sup>2</sup>C, 2/3 bus
- Configurable:** ASEDrive internal firmware downloadable from PC
- Ready for the future:** PC/SC Ready

- **ASESoft™**, the software library for smart cards
- Versatile:** Supports most smart card types
- Powerful:** Interoperability with high level API or transmission level API
- O/S savvy:** Supports Windows NT, 95, DOS
- **ASECards™**, a wide selection of smart cards. Memory, protected memory, CPU and Cryptographic cards support
- **ASE Cryptographic Library\***  
RSA; DES; TripleDES support and more. Compatible with Microsoft PC/SC cryptographic tools
- **ASE-FES™**, Sample file encryption system based on smart cards

**To order your ASE developers kit  
visit our web site today – [www.aks.com](http://www.aks.com)!**

**North America** **Aladdin Knowledge Systems Inc.** 800 562-2543, 847 808-0300, Fax: 847 808-0313, Email: [ase.sales@us.aks.com](mailto:ase.sales@us.aks.com)  
**Int'l Office** **Aladdin Knowledge Systems Ltd.** +972 3 630 2222, Fax: +972 3 537-5796, Email: [ase.sales@aks.com](mailto:ase.sales@aks.com)  
**Germany** **FAST Software Security GmbH & Co. KG** +49 89 89 42 21 65, Fax: +49 89 89 42 21 40, Email: [info@fast-ag.de](mailto:info@fast-ag.de)  
**UK** **Aladdin Knowledge Systems UK Ltd.** +44 1753 622 266, Fax: +44 1753 622 262, Email: [sales@aldn.co.uk](mailto:sales@aldn.co.uk)  
**Japan** **Aladdin Japan Co., Ltd.** +81 426 60-7191, Fax: +81 426 60-7194, Email: [sales@aladdin.co.jp](mailto:sales@aladdin.co.jp)  
**France** **Aladdin France SA** +33 1 41-37-70-30, Fax: +33 1 41-37-70-39, Email: [100622.1522@compuserve.com](mailto:100622.1522@compuserve.com)  
**Benelux** **Aladdin Software Security Benelux B.V.** +31 24 648-8444, Fax: +31 24 645-1981, Email: [aladdin@worldaccess.nl](mailto:aladdin@worldaccess.nl)  
**Russia** **Aladdin Software Security R.D. Ltd.** +7 095 923 0588, Fax: +7 095 928 6781, Email: [aladdin@aladdin.msk.ru](mailto:aladdin@aladdin.msk.ru)

© Aladdin Knowledge Systems 1997 (8/97) ASE is a trademark of Aladdin Knowledge Systems. \*Subject to export license

**1 - 8 0 0 - 5 6 2 - 2 5 4 3**

**W W W . a k s . c o m**

**ALADDIN®**  
KNOWLEDGE SYSTEMS LTD

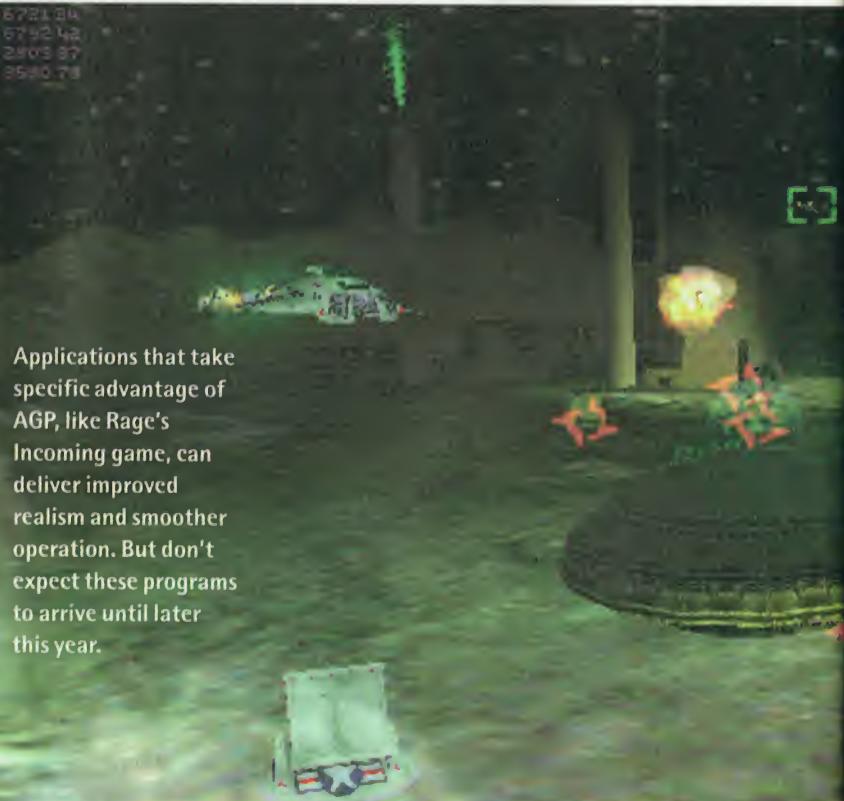
## AGP: Who Needs It?

*Intel's new LX chip set with support for Accelerated Graphics Port relieves PC bottlenecks. But applications and OSes that exploit it aren't here yet.*

**T**he first PCs that use Intel's new 440LX chip set, which is designed to optimize the performance of Pentium II PCs, have arrived. But software that takes advantage of these new capabilities definitely has not.

Intel's 440LX delivers support for synchronous DRAM, 33-MBps Ultra DMA, and other technologies that improve PC performance. But most of the focus with the 440LX is its support for Accelerated Graphics Port (AGP), which relieves congestion on the PC's PCI bus by moving graphics traffic onto a dedicated point-to-point channel between the graphics controller and the system chip set. And although developers say future versions of their programs will take advantage of AGP, BYTE found no significant difference in performance between the PCI and AGP versions of a popular graphics card when running 3-D modeling and visualization programs on a 300-MHz Pentium II PC.

AGP is designed to improve the graphics performance of Pentium II systems by providing a direct link between a PC's graphics card processor and system RAM through the core chip set. This gets the graphics card off the slower (133-MBps) PCI bus and onto its own dedicated channel. Intel claims AGP will speed graphics operations by allowing texture maps and other graphics data to be moved through a 66-MHz channel directly to main memory. The first implementation of AGP (called AGP-1x) will result in an effective doubling of graphics bandwidth over today's PCI to 266 MBps. Some vendors of graphics accelerator chips and boards will initially support AGP-1x, while others will support AGP-2x, which will deliver about 533 MBps. In 1999, AGP-4x will offer bandwidth of more than 1 GBps.



Applications that take specific advantage of AGP, like Rage's Incoming game, can deliver improved realism and smoother operation. But don't expect these programs to arrive until later this year.

Intel officials say a PCI graphics card in a Socket 7 system doesn't provide enough bandwidth for high-end graphics, and that AGP solves this problem by letting graphics and other data run in parallel over separate channels. But some vendors say the problem with PCI isn't one of bandwidth but one of contention. "The limitations of PCI affect graphics only when your SCSI, network, and graphics cards are contending for resources at the same time," says Phil Parker, director of corporate communications at Number Nine Visual Technology. In most cases, he says, a slow graphics processor, not the PCI bus, is the bottleneck.

BYTE polled Intel and numerous graph-

ics accelerator vendors, and none could provide the name of a single application currently suffering from a bandwidth limitation when using a PCI graphics card. (However, Intel officials say this is partly due to developers who write applications, such as games, so they don't exceed the PC's available bandwidth.) Despite this, many vendors, including Number Nine, Matrox, STB, and ATI, are already fielding AGP-based graphics cards.

Another advantage of AGP touted by Intel is that it reduces the amount of video memory that must be present on a graphics card. AGP allows the use of system memory as a virtual extension of a graphics card's memory, so that a system ven-

dor can include a 4-MB video card instead of an 8-MB one.

But board vendors and software developers dismiss this idea as not meriting serious consideration for high-performance graphics. "Graphics memory is cheap," Number Nine's Parker says. "We see the AGP bus as being a very large pipeline that feeds our graphics technology. 3-D applications will benefit with our AGP implementation by being able to send large textures across the high-speed AGP bus a single time and caching those textures in our processor's 8-KB internal texture cache and on the board's



local memory, up to 16 MB. Once the texture is on-board, the on-board graphics engine can manipulate those textures at speeds of up to 1.6 GBps [which is faster than AGP]. In this case, additional memory on the host is the secondary cache." John Heap, spokesman for U.K.-based Rage Software, whose forthcoming game Incoming will take special advantage of AGP by using highly detailed, large textures, agrees. "It is more beneficial to use the local RAM [on a video card] and then use AGP and system memory as an over-draft on local texture memory."

Several factors are contributing to AGP's lukewarm reception—with the lack of currently bottlenecked applica-

tions heading the list. Some manufacturers point out that the increase in the speed of the PCI bus from 33.3 MHz to 66.6 MHz will allow it to shoulder more of a load when servicing graphics cards and postpone any real need for AGP. IT managers also face an additional support headache: Those who embrace AGP will have to support two different styles of video boards—something we thought we left behind with VLB on the 486.

Finally, there's the question of what to do with AGP when you get it. Currently, OS support is minimal. Although touted as a technology for high-end workstations, AGP won't be supported in NT until version 5. For Windows 95, an Intel-written VxD is currently available, but native support for AGP isn't planned until the release of Windows 98.

So who needs AGP? Applications that specifically exploit it are not available today, but AGP puts the foundation in place to provide better support for developers of games and other programs that can benefit from smoother play and more realistic images. And, AGP also provides an immediate benefit by freeing up the PCI slot from having to carry graphics traffic, giving more headroom to high-speed PCI networking peripherals and hard drives. So if you buy a new AGP system, you might as well buy an AGP board, especially since it will likely cost no more than the PCI version of the same card. In the meantime, as we wait for applications that really show off AGP's benefits, it will be interesting to see if some vendor finds a new way to use this contention-free, high-bandwidth channel that's different than what Intel originally envisioned.

—Robert L. Hummel

## File Servers Get Thinner, Cheaper

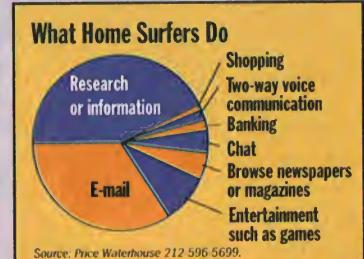
You've heard of thin clients—now look out for thin servers. Several vendors are touting new file servers that offer easier installation, more flexibility, and lower prices than traditional file servers.

Although implementations vary, these new file servers (also known as network drives or direct-attached storage devices) usually include a low-cost RISC processor, real-time operating system, built-in network connections, ASICs, and disk enclosures for mass storage. The real-time OS approach lets vendors base these

## Geek Mystique

### Internet Killed the TV Star

Household activities replaced by Internet usage include watching TV (35 percent) and reading (31 percent), according to the 1997 Price Waterhouse Consumer Technology survey. Three out of four surveyed don't have Internet access, and almost half



Source: Price Waterhouse 212 596 5699.

(46 percent) of respondents without Internet access said they would "never" get Net access at home. But most of those naysayers were 35 years old or older. That means technology companies should focus their efforts on the up-and-coming cybergeneration.

thin servers on inexpensive dedicated I/O chips instead of general-purpose CPUs such as the Pentium.

Because vendors port standards such as NFS, HTTP, SMB, and HTTP to run over their real-time OSes, these thin servers can appear as just another drive or server to other computers or applications on the network. Attach a thin server to the network, and the system will

## Contents

### Ink-Jet Printers: Not Just for the Low End

22

### Bugs Found on Mars

23

### NT Clustering Compared

26

### What's Ahead for Windows

32

# Now that APC Smart-UPS® includes FREE web-enabled PowerChute® *plus*, protecting network uptime has never been easier



November 19, 1996  
APC Smart-UPS 1000

"...Inherent flexibility and excellent software... Don't be caught without one."



Power problems attack networks relentlessly. To protect hardware and data from system crashes, experts, network managers and computer users worldwide prefer one solution above all others combined: APC Smart-UPS. Now, all 120V Smart-UPS include FREE PowerChute *plus* power management software.

## The most reliable protection you can buy

Smart-UPS provide complete protection against power spikes, surges, brownouts, and blackouts. You'll also gain maximum server uptime and decrease management costs. Award-winning features include:

- CellGuard™ intelligent battery management monitors battery performance and extends battery life.
- SmartSlot™ internal accessory slot lets you customize and enhance the performance of your Smart-UPS.
- QuickSwap™ user-replaceable batteries can be quickly and safely swapped out without powering down the connected equipment.



PowerChute *plus* provides unattended system shutdown and UPS management for Windows NT, Netware and other servers. Manage Smart-UPS via SNMP, DMI and Web browsers (shown above). Features vary by operating system.

## Plan for and control crisis situations

PowerChute *plus* FlexEvents™ lets you control UPS reactions to power events. You can configure PowerChute *plus* to provide graceful, unattended server shutdown during an extended power outage or alert you to out-of-bounds environmental conditions before they result in costly downtime.

## Web server and SNMP ready

APC's NEW WebAgent™ allows you to monitor and manage your Smart-UPS using your Web browser. New WebAlert™

notifies users of Web server shutdown via their browser. PowerChute *plus* also includes the PowerNet™ SNMP Agent

©1997 APC. All Trademarks are the property of their owners. SU01EF

(800)347-FAXX PowerFax

CompuServe: GO APCSUPPORT

132 Fairgrounds Road, West Kingston, RI 02892 USA

Dept. A2-SW

APC has won more awards for reliability than all other UPS vendors combined.



Circle 103 on Inquiry Card.

# APC

(888) 289-APCC x8199

Fax: (401) 788-2797

<http://www.apcc.com>

## BYTE International Partners

### Argentina

Tel: +582 993 6356

Circulation: 20,000

### Brazil

Tel: +55 11 214 1234

Circulation: 60,000

### Bulgaria

Tel: +359 2 651 313

Circulation: 4,500

### Chile

Tel: +582 993 6356

Circulation: 10,000

### Colombia

Tel: +582 993 6356

Circulation: 17,000

### Greece

Tel: +30 1 333 555

Circulation: 30,500

### Japan

Tel: +813 5210 8111

Circulation: 80,000

### Korea

Tel: +822 588 3100

Circulation: 10,000

### Mexico

Tel: +525 605 9962

Circulation: 11,000

### Middle East

Tel: +962 6 650 444

Circulation: 20,000

### Romania

Tel: +40 65 166 516

Circulation: 7,000

### Spain

Tel: +34 3 453 0717

Circulation: 40,000

### Taiwan

Tel: +886 2 8780 3636

Circulation: 16,000

### Thailand

Tel: +66 2 439 4600

Circulation: 30,000

### Turkey

Tel: +90 212 512 9271

Circulation: 22,000

### Venezuela

Tel: +582 993 6356

Circulation: 18,000

### Yugoslavia

Tel: +38 11 444 3663

For more information on publishing BYTE in your language,  
contact:

Brad Browne, International Licensing Director

The McGraw-Hill Companies, Inc.

One Phoenix Mill Lane, Peterborough NH 03458

Tel: 603/924-2501 Fax: 603/924-7620 e-Mail: [bbrowne@mcgraw-hill.com](mailto:bbrowne@mcgraw-hill.com)



# BYTE Speaks Your Language ... and your Customer's Language!

Did you know that BYTE is published in 12 languages? BYTE's International Partners extend your marketing reach by another half million!

**BYTE** The Future of Information Technology Today

**4 WAYS TO ENERGIZE YOUR INTRANET**

**New Chips Challenge Pentium II**

**AUGUST 1997**

**9 Powerful Clusters Compared p. 126**

**Databases: Not Your Father's DB/2 p. 133**

**WIN a WinBook See page 115**

**Dragon's NaturallySpeaking, IBM's Cryptolope**

**Reviews: Best of complex, Cheap Color Lasers**

**Reviews: Smart Components p. 56**

**Reviews: Reliable Transactions p. 77**

**Reviews: Shared Data p. 69**

**Reviews: Managed Content p. 59**

**HOT TECHNOLOGY**

**EXTEND YOUR ENTERPRISE**

Combining digital cellular phones, hand-held PCs, and custom Windows CE apps

**BYTE.com**

0 74808 02662 3

A Publication of The McGraw-Hill Companies

Reach the Technology Elite of BYTE — the professionals who make real technology decisions every day — in 17 countries. These readers determine the appropriate technology strategies needed to solve corporate business problems, and they evaluate and recommend the purchase of the necessary products to do so.

For information on advertising or subscribing to any of the BYTE International versions, see the individual telephone numbers listed on adjoining page.



configure itself (while likely asking you a few questions on the way) without requiring you to shut down your server. Using a real-time OS that supports popular networking protocols, instead of NT or NetWare, lets you add storage devices without having to buy new OS licenses. And since you manage the storage using another PC that's already on the network, these miniservers don't require keyboards, monitors, mice, or other peripherals. The end result: a mini file server that's about the size of a bread box and is available for a price that starts at less than \$1000.

Mike Peterson, president of Strategic Research (Santa Barbara, CA), a market research firm that covers storage management, says these new types of network-ready storage products offer easier installation and management than traditional solutions, while letting workgroups add storage close to the users



Creative Design's external Plug & Stor weighs just 3.5 pounds and includes built-in network connections.

rather than at a centralized location. Network-ready storage systems reduce the data traffic going out from one workgroup's subnet across the network.

Several vendors have begun shipping such devices, including Creative Design Solutions (408-653-1330; <http://www.creativedesign.com>), Axis Communications (617-938-1188; <http://www.axis.com>), and soon, Mylex's Network Power & Light division (510-608-2222; [npl@mylex.com](mailto:npl@mylex.com)). Creative's Plug & Stor 100 internal version is an AT motherboard for building storage servers, while the 3.5-pound external version (see the photo) includes a 3.5-inch drive bay and attaches directly to the network. While other vendors use I/O processors, Creative uses the Pentium. Axis' StorPoint HD family uses multiple Iomega transportable Jaz drives and sells at prices starting at \$999. Mylex's NPL division won't formally announce its products until later this year, but company officials confirm the products will be based on a dedicated I/O processor and a real-time OS.

Net drives satisfy a variety of needs, especially affordable storage additions for workgroups, vendors say. However, these devices aren't suitable for all server/storage needs. For one thing, unless based on a high-performing CPU that can run NT or a commercial Unix, these peripherals won't be useful as application servers. Also, initial systems are not powerful enough to scale into high I/O loads that a large disk array needs. Like network PCs, network-ready drives won't solve every problem. But they offer an easy, affordable solution to many storage management problems today.

-Dave Andrews

## Ink-Jets: No Longer Just Low-End

Printer vendors are finding new high-end uses for ink-jet technology. Prices for color ink-jet printers continue to drop, and many companies will continue to market color ink-jets that sell for under \$150. But ink-jet technology is increasingly being used to tackle a host of high-end design, engineering, and graphics tasks.

In the small office or home environment, color ink-jets have beaten out low-end laser printers. According to IDC (Framingham, MA), a research and consulting firm, 5-pages-per-minute (ppm) color ink-jets average \$425, while 8-ppm monochrome lasers cost \$525. The price of this class of laser printers has dropped only 12 percent from 1996, while ink-jet prices have dropped 16 percent in the same time. Plus, these color ink-jets have achieved near-photographic color quality.

Ink-jet companies say color ink-jets will further encroach on other classes of laser printers. "The price for lasers is coming down fast," says Dan Crane, vice president of marketing for Epson. "I think the collision will be at \$999." To compete, ink-jets must improve print speeds considerably. Currently, most classes of ink-jet printers are limited to around 5 ppm in monochrome and 3 ppm in color. Ink-jet vendors generally inflate these estimates, warns Charles LeCompte, publisher of the *Hardcopy Observer*, an industry newsletter. But "there is no ques-

## Future Watch

### New Design for Cheaper Digital Cameras



A new design guideline for digital cameras should make these devices work better with PCs and cost less.

Started by Intel and supported by HP, Eastman Kodak, Microsoft, and others, the Portable PC Camera '98 Design Guideline places the responsibility for compute-intensive tasks (such as image decompression and enhancement) with the PC processor instead of the camera. Only minimal compression takes place in the camera, reducing the compute requirements for on-camera microprocessors. Minimal compression means the cameras will require more storage, which is why the guideline also calls for removable flash memory. Other key components include support for the FlashPix format and Universal Serial Bus. Intel says the spec, by giving more of the image capture work to the PC processor, will reduce the price of a camera by about \$100. But just as important, the guidelines call for smoother integration with PCs. Products based on the guideline should start appearing next year.

tion they will squeeze higher speeds out of these machines," he says. "You can shoot more drops onto the page, or get the ink to dry faster, but some technology will emerge that can improve on what printers are achieving today."

A collision between workgroup laser printers and color ink-jets will not happen for some time. Ink-jet printing speed will probably not increase significantly for several years. The next-highest class of laser printers is the "deluxe personal laser printer," and no ink-jet has been able to match the speed (around 12 ppm) and monochrome text printing capabilities of this class. These lasers will continue to be affordable printers for high-volume monochrome document printing. Laser printers are rapidly coming down in price. They now offer higher print speeds with color printing at prices that start around \$3000 (see "Color or Lasers: Cheaper, More Compact," August Bits). Also, according to Marco Boer, consultant partner with IT Strategies, color ink-jets are poorly positioned to compete with workgroup printers because only 2 percent of ink-jet printers have network interface cards.

Several strategies are in use to improve speeds in ink-jet printers. Hewlett-Packard's 1600C has paper-heating elements to speed the drying process, but this is an inelegant solution and is not likely to be common in the future. Epson has two technologies that are potentially beneficial—quick-drying ink and piezo print heads—but they have yet to result in significant improvement. The quick-drying ink has not yet produced faster print speeds and, like most color ink-jet printers, requires special paper. Micro piezo print heads, which use electronic impulses instead of thermal pressure, could significantly improve printing speeds, but most vendors are committed to thermal printhead technology.

Despite the limitations, it is a mistake to dismiss color ink-jets as consumer appliances, specialty devices, or low-end color printing solutions. IT Strategies estimates that \$19 billion will be spent on wide-format graphics printers (with a printing width in excess of 24 inches) by the year 2000. Ink-jets are a major player in this market. In 1996, 6700 such color ink-jet systems were sold, expected to climb to 24,000 by the end of the century. These printers replace crude CAD plotter printers and are widely used for proof-

ing by art departments. Designers can create inexpensive proofs, and it is simple to output big, bold prints in-house. Color ink-jets are making inroads into print production houses. As professional printers increasingly turn to ink-jets, sales of electrostatic printers have declined 18 percent, and wide-format ink-jets have experienced a 6 percent jump during the same time.

Typical of these color ink-jet printers is the Hewlett-Packard DesignJet 2500CP (\$11,995). It has 600-dpi print resolution and can print 16 million colors on paper up to 3 x 150 feet. Some manufacturers are betting on smaller wide-format printers, giving people outside design departments more printing options. The Epson Stylus Color 3000 (less than \$2000) enables professional graphics artists and digital photographers to produce color proofs. It prints on paper ranging from 4 x 4 inches to 17 x 22 inches. Tektronix is offering similar functionality in its wide-format solid-ink printers. Ink-jets are beginning to penetrate the textiles market, too. Canon is selling an ink-jet printer to textiles companies that's priced around \$1 million.

Vendors will continue to focus on mainstream consumer printers. But for graphic artists, engineers, and office workers, cheaper, wide-format color ink-

jets are offering some of the same printing capabilities that professional print shops are deploying.

—Jason Krause

## Better Networks Through Accounting

A new class of applications lets IS managers track who uses valuable network resources and helps them better plan for network usage and capacity. Whether it's called network accounting, Internet accounting, or data accounting, one thing is apparent: Managers now have a way to see who's using the network, how much, and for what purpose.

In most corporate settings, each department or profit center is billed back for use of services—phone calls, paper, secretarial help. Most firms have a lot of money invested in data networks, so some might ask: Why shouldn't the departments or divisions that demand improved access and connectivity (e.g., to the Internet) be charged for that use rather than having it all come from corporate overhead?

Until now, such networking expenses were usually billed to the data processing budget. But in almost every other

## Bug of the Month

### Man Finds Bugs on Mars

Wherever a computer goes, bugs are sure to follow. When the Mars Pathfinder developed a glitch, NASA had to somehow upload new code without losing valuable time needed for exploration. The most confounding bug on the Pathfinder mission appeared July 10. Steven Stolper, software engineer for the Mars Pathfinder, calls it "one in a million, insidious, and hard to replicate." The snafu arose because the OS, Wind River's VxWorks, developed a mutual-exclusion problem: A low-priority function (in this case, recording weather) interfered with the system's multi-tasking schedule. The system couldn't finish all the tasks it needed to, missed a real-time deadline, and then shut itself down. "It's a kind of interplanetary Control-Alt-Delete," says Stolper. "When things go wrong, the system



PHOTOGRAPH: NASA/JPL/CALTECH © 1997

Pathfinder bugs inhibited the Rover.

goes into a power-safe mode and waits for ground control to help out." Without a fix being implemented, this problem would replay itself over and over.

To identify the bug, engineers recreated the malfunction on Earth, identified the offending subroutine, and uploaded the binary difference between the new code and the buggy code on the Pathfinder. —Jason Krause

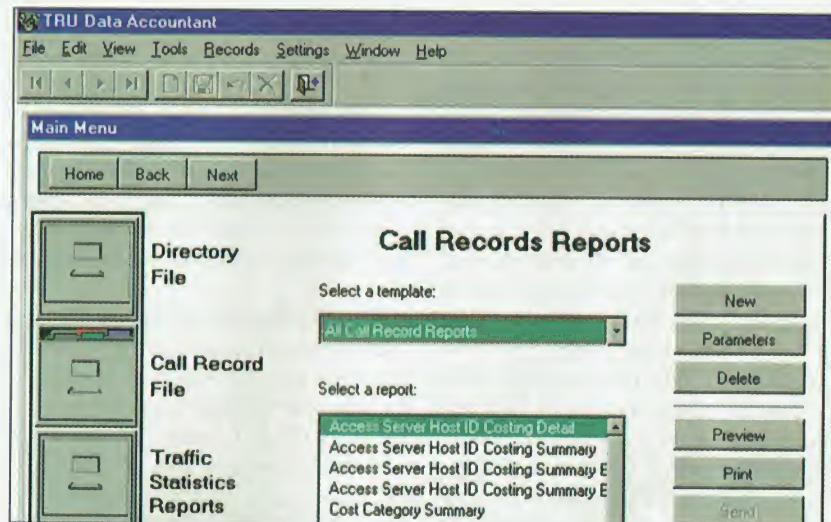
*Send yours to [jkrause@mgh.com](mailto:jkrause@mgh.com)!*

accounting bracket, use of resources such as long-distance phone calling gets billed back to the department that uses the resource. Call accounting for telephone calls is widespread and accepted when it comes to voice communications. Soon, the same might be said of data accounting for data calls. As desktop videoconferencing, broadband Internet access, and other bandwidth-hungry applications become commonplace, network planners and bean counters are demanding records of use.

The State of Montana is investigating the possible tracking of data traffic for bill-back and for network planning purposes. "We are hoping to integrate both our data and voice systems into a single system," says Carl Hotvedt, bureau chief for network operations for the state. Such a system would let managers like Hotvedt answer basic questions such as: Who is using the network, how much, for what purposes, and at what cost?

Another common assumption is that if existing bandwidth is not used, it is simply wasted. But no network is free. Somewhere, somebody gets a bill. Increasingly, the financial officers who approve these bills seek to lower or minimize network costs. Simple applications, like in-band transmission of e-mail over the Internet or corporate intranet, need to be accounted for when planning network capacity. Bandwidth is not free any more than long-distance calls or 800 numbers are free. Accountants want to allocate bandwidth use to profit centers. To do that, network planners have to find ways to account for use.

Cisco Systems (408-526-4000; <http://www.cisco.com>) markets a product called Cisco Enterprise Accounting. CEA



**Telco Research's data network tracking application lets you monitor usage patterns in your company.**

1.0 supports accounting, billing, and reporting of ISDN applications. The software is hardware device-independent. Any Cisco device supporting the Cisco ISDN Call History MIB (11.0(7) or later) can be polled. Raw call data is captured by CEA's SNMP poller and is stored in the software management information bases (MIBs). CEA then translates and filters raw call data into standardized or flexible call data records (CDRs), which are stored in a relational database that drives applications such as end-user accounting, cost allocation, and traffic statistics. In addition, network monitoring lets managers catch network use that's excessive or in violation of a firm's policies.

Transmission costs far outweigh all other network costs combined, according to Cisco's Bob Berlin. The system Cisco markets was designed by Telco Research

(Nashville, TN; 800-488-3526; <http://www.telcores.com>) and runs on PC-based software linked to a router. The software catches FTP, e-mail, Internet telephony, and all other traffic that passes through the router. "This allows management to build a history," says Stephen Doster, Telco Research's director of marketing. "It is a great tool for network planning and optimization." The State of Montana also uses Telco Research's call accounting system, and Hotvedt hopes to integrate call accounting and data accounting.

Other firms' new releases of network management software, like ForeView 4.1, from Fore Systems (412-772-6600; <http://www.fore.com>), let integrators and managers mine data-usage figures. According to Fore's David Colodny, network operators need an accounting tool both for billing and for performance analysis, including capacity and quality of service. Fore's tool, developed with PBX switch manufacturer Nortel, is software-based. It collects 40 variables, ranging from call duration to number of calls received.

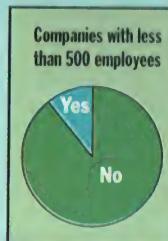
Telemate.net, from Telemate (770-963-3700; <http://www.telemate.com>), sifts information from most common firewall logs. Data can be sorted by individual user, company division, or geographic location. "Rather than shutting off use for different sites, like news or entertainment, this allows MIS to hold workers and managers responsible for their use," says Bill Lassiter, marketing manager. The program allows varying

## Survey

### Will You Implement Wolfpack?

Most companies with under 500 employees won't use NT's integrated cluster failover technology (aka Wolfpack).

Source: BYTE Research Dept. survey. Total responses equals 111.



A higher percentage of companies with 500 or more employees plan to use Wolfpack.

Source: BYTE Research Dept. survey. Total responses equals 25.



# THE IDEA BEHIND OUR MODULAR DATA STORAGE SYSTEMS AS EXPLAINED BY AN

*ISmanager.*



 **WHEN IT COMES TO** storing data, modularity and flexibility are big ideas. So we design Kingston® storage enclosures for optimum growth and custom configuration. Of course, compatibility is critical, too.

[www.kingston.com/storage](http://www.kingston.com/storage)

That's why we are implementing a certification program with all the major drive and controller manufacturers, including Adaptec®, CMD®, DPT®, Mylex®, Quantum®, and Seagate®. Want to make configuring custom storage systems as easy as child's play? Just call (800) 435-0670. Or visit our Web site at [www.kingston.com/storage](http://www.kingston.com/storage).



The industry's  
longest warranty.

**Kingston**  
TECHNOLOGY  
STORAGE PRODUCTS DIVISION

Circle 101 on Inquiry Card (RESELLERS: 102).



Kingston Technology Company, 17580 Newhope Street, Fountain Valley, CA 92708-3535, (714) 438-1847. © 1997 Kingston Technology Company. All rights reserved. All other trademarks and registered trademarks are the property of their respective owners. DUPLO and LEGO are trademarks of the LEGO Group.

bill-back charges by time of day, bandwidth, or number of packets used. Telemate.net automatically prepares paper or e-mail reports daily, weekly, or monthly to make sure information is distributed.

Sequel Net Access Manager, from Sequel Technology (206-556-4000; <http://www.sequeltech.com>), is available in a server version and in a personal version

called NetPIM. It filters each IP packet and reports both Internet and intranet traffic, allowing accounting for use. Cost is \$499 for a five-user server pack, \$20 for the single user.

Bandwidth accounting also is valuable as a planning tool. Exception reporting (crashes, fraudulent use, congestion) helps a network manager see where in the

network added capacity is needed. One thing that's starting to change is the concept of the free data network ride.

"The thing to overcome is this notion that bandwidth is free," says Telco Research's Doster. "The voice people know all about charge-back, and now the same is true for data networking."

—Curt Harler

## Datapro Report

### NT Clustering Solutions Compared

NT clustering solutions, including Microsoft's Cluster Server (Wolfpack), provide affordable ways of maintaining high availability of computing resources. Wolfpack is slated to ship soon, but other solutions already offer capabilities that Microsoft doesn't (yet).

#### Digital's Clusters for Windows NT

(800-344-4825; <http://www.digital.com/>)

With Digital's Clusters for Windows NT, two active servers are coupled via a shared SCSI bus to create a single system environment. Each storage device on the SCSI bus is assigned to one or the other server. If one server fails, the other server assumes the failed server's workload and shared storage and file shares. Applications automatically restart on the second server, and Windows clients are automatically reconnected. The two serv-

ers need not be identical, but they must both be either Alpha servers or Prioris (Intel) servers. The disks in the shared storage do not need to be Digital disks.

Digital's Clusters for Windows NT boasts numerous application recovery scripts. The cluster management software is strong and offers better integration with server management software than other solutions.

#### Microsoft's Cluster Server

(206-882-8080; <http://www.microsoft.com>)

MSCS allows failover between two servers in a shared storage cluster. A second version, expected in late 1998 (or 1999), will support larger clusters and additional cluster functionality, including scalability.

MSCS will initially be supported only on validated configurations. If MSCS is in your plans, ensure that your servers, including the hard drive and network

cards, have been validated. Currently, MSCS requires both servers to be identical models.

MSCS is a safe, albeit minimal, choice. You'll have to write many of your own application failover agents or wait for Microsoft and other developers to provide them. MSCS doesn't support automatic failback, and the lack of a TCP/IP recovery agent for MSCS is disappointing.

#### NCR's LifeKeeper

(800-774-7406; <http://www.ncr.com>)

Datapro believes that NCR's LifeKeeper is the most comprehensive and flexible clustering solution currently on the market. With its ability to run on many vendors' servers, its support for failover plus a degree of load balancing, its numerous application recovery kits, its two-node active/active or three-node active/standby configurations, its ability to reconnect all client types with-

out additional client software, and its choice of shared or mirrored storage, LifeKeeper should be given first consideration by any organization that's planning to install an NT cluster.

#### Veritas' FirstWatch

(800-258-8649; <http://www.veritas.com>)

FirstWatch is available from Veritas or its distributors (Data General, for example, provides a bundle called Cluster In A Box with its Avion NT servers). Configurations can consist of two servers that are normally active and can failover to each other. Or, a FirstWatch configuration can consist of up to four active servers that may each failover to an idle standby server. FirstWatch also includes a management tool that can be used locally or remotely with any Web browser.

—Jane Wright

For more on Datapro reports: 609-764-0100; fax: 609-764-2814; <http://www.datapro.com>.

### Clustering Product Comparison

	Clusters for Windows NT	Cluster Server (WolfPack phase 1)	LifeKeeper	FirstWatch
<b>Developer</b>	Digital Equipment	Microsoft	NCR	Veritas
<b>Platforms supported</b>	Digital Prioris servers, Digital Alpha servers	Validated server models from a variety of vendors	NCR, Amdahl, IBM, HP, Sequent	Certified Intel/NT servers
<b>Automatic failback</b>	Yes	No	Yes	Yes
<b>Bidirectional failover</b>	Yes	Yes	Yes	Yes
<b>Max. number of servers in cluster</b>	2	2	3	5
<b>Number of application recovery kits available</b>	9	4	9	8
<b>List price per server (US\$)</b>	\$995	Pricing information not yet available	\$2000	\$2475



# BUILD THE INTERNET INTO JUST ABOUT ANYTHING!

HERE'S PROOF

THIS 1.44M SELF-BOOTING WEB DEMO CONTAINS:

- POSIX-certified RTOS
- Full Windowing System
- HTML 3.2 Browser
- Embedded Web Server
- TCP/IP with PPP
- Internet Dialer
- ... and More!

## The Internet Appliance Toolkit (IAT) includes:

everything on the demo, plus

visual application builder

built-in internationalization

Watcom C/C++ compilers

drivers for hundreds of PC peripherals

embedded filesystems

demo apps with source files

scalable fonts

embedded OEM pricing

... and much more!

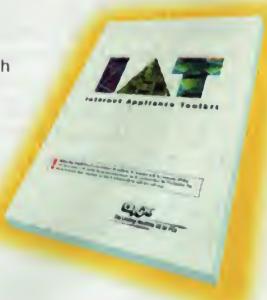
Build the Internet into smart phones, set-top boxes, photocopiers, kiosks, printers, PLCs ... anything!

Better yet, build it on time. The IAT™, used to create this demo, comes with everything you need, from rapid application development tools to Internet apps to source code. Build a custom browser in days, not months!

And talk about performance. With the IAT and QNX you can use low-cost x86 platforms to deliver incredible speed and reliability. Believe it!

**Download your free 1.44M demo today!**  
**[www.qnx.com/iat](http://www.qnx.com/iat)**

or call:  
**800 676-0566 (ext. 1047)**



**QNX®**

*The Leading Realtime OS for PCs*

## Book Reviews

### New Media's Next Revolution

In the age of hypertext, cybersurfing, and interactive virtual environments, we sense ourselves at the cusp of something revolutionary, and yet, at the same time, we feel somewhat underwhelmed. For many users, the reality of the Internet falls short of its possibilities. If we are to fill the gap between promise and reality, it will take visionaries who understand the technical hurdles and the new structural and aesthetic mechanics to transform the media rather than simply recompose it.

Janet Murray, who explores the rich possibilities of new electronic media in her book *Hamlet on the Holodeck*, is uniquely qualified to elucidate the challenges ahead. In addition to holding a Ph.D. in literature from Harvard, she is a senior research scientist in the Center for Educational Computing Initiatives at MIT and teaches interactive fiction in MIT's Film and Media Studies Program. Murray broaches the technical changes needed, such as interfaces designed to fully exploit an interactive/interconnected world, advanced authoring tools for developing "immersive" environments, and a more robust infrastructure to deliver the goods. She also discusses the artistic flourishes required to make the new technologies sing. She argues eloquently for a new genre of interactive narrative, not just for gaming and entertainment but to propel us into a new media age, an age as significant as the one brought about by moving pictures and the widespread acceptance of television.

Murray describes an environment where clicking on a character changes the perspective of the interactor, shifting the viewpoint and even the values and judgements



The FUTURE of  
NARRATIVE in  
CYBERSPACE

Janet H. Murray

of the narrator, where moving to a different room triggers completely new storylines or interface modes, where interactive television shows develop fully realized worlds beyond a single episodic slice. She also cites real-world experiments, from the MIT Media Lab and other sources. At MIT, for example, a 12-foot computer screen acts as a "magic mirror," reflecting the interactor's image among virtual characters.

An intimate account of her experiences at Sony's IMAX Theater in New York, a 3-D theater with a screen eight stories high and a hundred feet wide, describes an environment where characters from the past become "a resurrection of the dead; we are given the ability to see them and to see the world through their eyes with stunning immediacy." Such piquant examples animate the possibilities

of the new media and make us hunger for more accessible technologies. As the title suggests, the book is steeped in references to literary and popular culture. Just after detailing a sequence from the *Star Trek* holodeck, the author grapples with moral implications of Aldous Huxley's *Brave New World* and Ray Bradbury's *Fahrenheit 451*, two seminal works about the dehumanizing propensities of immersive technologies. She seems equally comfortable citing Shakespeare, Joyce, or *Babylon 5* while displaying a firm grasp of the technology's historical development.

But this is not simply a book about 3-D games and *Dungeons and Dragons* across the Internet. *Hamlet on the Holodeck* resonates best when it reaches beyond the scope of interactive narrative and encompasses the global possibilities of emerging technologies. As we develop technologies and interfaces that are more interactive, more immersive, and more compelling, every aspect of the computing experience is enriched. It is toward this future that Murray draws us, a future where seamless interfaces, robust architectures, and new interactive genres enable computing environments that we cannot now envision.

**Stan Diehl** is a frequent contributor to *BYTE*. He used to be the director of the *BYTE* Lab.

#### Hamlet on the Holodeck

by Janet H. Murray, The Free Press, a division of Simon and Schuster, 1997  
324 pages (hardcover); \$25  
<http://www.SimonSays.com>  
ISBN: 0-684-82723-9

## Stock Shopping on CD

Not quite blue chip

If ever there were a marriage made in cyberheaven, it's the Internet and stock trading. Traders require the kind of dynamic, up-to-the-minute access to information that the Internet delivers. *The Stock Shop with Peter Lynch* combines multimedia presentations with an on-line link to financial data.

In a set of solid tutorials, Lynch, former manager of Fidelity Magellan Fund, uses audio narration, video clips, and slick interactive worksheets to cover basic terminology, financial analysis, and key market determinants.

Lynch looks for a tangible reason to invest in a stock, what he calls a company's "story." You build a company's story by analyzing financial numbers, by considering the corporate vision, and by using your own knowledge and experience. Through an Internet link, *The Stock Shop* captures dynamic

The Stock Shop with Peter Lynch

CONSULTATION RESEARCH STOCKS DETAILS COCA COLA

Overview Company Information Categorize Company Earnings Balance Sheet Operations Pricing Chart Recent Prices Chart Historical Prices Your Story

Annual (MM) 12/31/96 12/31

Cash + M\$ \$47

Net Cash + M\$ (\$5258) (\$4,1

ST Debt \$491

LT Debt \$4,814 \$4,

LT + ST Debt \$5,305 \$4,

Equity \$1,550 \$1,

Net Debt Ratio 77.23% 74.5

Cur Bond Rating A+

Peter's Comments

The Stock Shop

Houghton Mifflin Interactive  
\$69.95 (plus \$6.95/month for stock  
downloads through Telescan)  
<http://www.hminet.com>

financial data and flows the information into well-organized tables.

*The Stock Shop* is an effective tool, but the program should poll various news services for items directly related to selected companies. I also wanted more information about on-line trading, perhaps even a link to an on-line broker. In the marriage of Internet and stock trading, *The Stock Shop* comes up a little shy of a full commitment.

-Stan Diehl

The power HDD that gets you ahead in business - Samsung HDD



SpinPoint™



Samsung is opening a new chapter in HDD technology with its Winners & Voyagers line of products, offering unmatched quality and service - no matter where you live or work!

Samsung R&D engineers in San Jose Center are dedicated to bringing you the latest developments in HDD technology and capabilities. And Samsung's vast global network of service centers ensures prompt assistance to keep you on schedule and performing at your best. Wherever in the world you do business, Samsung will be there, dedicated to your success.

**Samsung HDD - Success depends on the right choice.**

Circle 111 on Inquiry Card.

Seoul, Korea TEL : 822-751-6114 FAX : 822-751-6989  
New Jersey, USA TEL : 1-201-229-4046 FAX : 1-201-229-4069  
Miami, USA TEL : 1-305-594-1090 FAX : 1-305-594-7335  
Frankfurt, Germany TEL : 49-61-96-582510 FAX : 49-61-96-661011

■ London, United Kingdom TEL : 44-181-391-8264 FAX : 44-181-974-2800  
■ Singapore TEL : 65-535-3075 FAX : 65-221-5510  
■ Wanchai, Hong Kong TEL : 852-2862-6924 FAX : 852-2866-1316  
■ Beijing, China TEL : 86-10-6505-2541 FAX : 86-10-6505-2543

**SAMSUNG**  
ELECTRONICS



www.teledotcom.com

A  
SITE  
TO BE  
SEEN

**tele.com**  
The Web Edition

## Blasts from the Past

### Years ago in BYTE

5

A big shift in personal computer architecture for video devices and other peripherals was arriving with PCI, QuickRing, and VL-Bus. QuickRing never really caught on, and VL-Bus had its time in the sun, but PCI eventually prevailed.



### Years ago in BYTE

10

Laser printers with roughly 2-ppm performance ranged from \$1995 to \$3695. While reviewing Tandy's new 386-based PC, we noted prices for 386 boxes had dropped from about \$6499 to \$4299 (with 40-MB hard drive and monitor) in about a year.

### Years ago in BYTE

15

Did the power of the PC spreadsheet help drive the leveraged buyout mania of the 1980s? Our cover story discussed how PCs and programs like VisiCalc were delivering new ways to quickly analyze complex financial data.

### Years ago in BYTE

20

We looked at a new high-level programming language that was originally designed to run under Unix on the DEC PDP-11 series of machines. This new language was called C. Also covered: How to analyze your car's gas economy with your computer; APL interpreters; and a BASIC version of the Othello game.

## Windows Wish List

*Jim Allchin, Microsoft senior vice president of U.S. business systems management, discusses what he'd like to add to future versions of Win 95 and NT.*



**BYTE:** *If you could add only one feature to the next versions of NT and 95, what would it be?*

**Allchin:** That's hard to say because frankly we still aren't finished adding to NT 5.0. But one thing we're working at, and that I want to continue to strive for, is tied to simplicity for the end user. For example, we're wiring in communications into every nook and cranny of the NT system so that it becomes a great citizen in transient networks and in wireless networks. Today if you are connected to a network, things run pretty well. However, if the connection drops in a particular line or if you move between cells and you're communicating, the system needs to be more intelligent about dealing with the changes in the network. Today, configuration can be time-consuming and complex, and certainly errors are not, in my opinion, handled on any system as seamlessly as they should be.

**BYTE:** *What are some other areas where you could make things simpler?*

**Allchin:** We're going to look at areas like the networking control panel and try to make it dramatically easier for remote access, which today takes like 26 steps to set up. Other areas to improve are in Plug and Play and autosensing whether a DHCP server is

in existence or not, and get rid of all this binding gunk that no one understands. My dream would be that the system can figure out a lot more about what's going on, not just in communications but in terms of the entire control-panel configuration. The control panel is confusing; we need to simplify that. With Memphis [aka Windows 98], we're not too interested in adding anything else new to the system. We are focusing on quality improvements now.

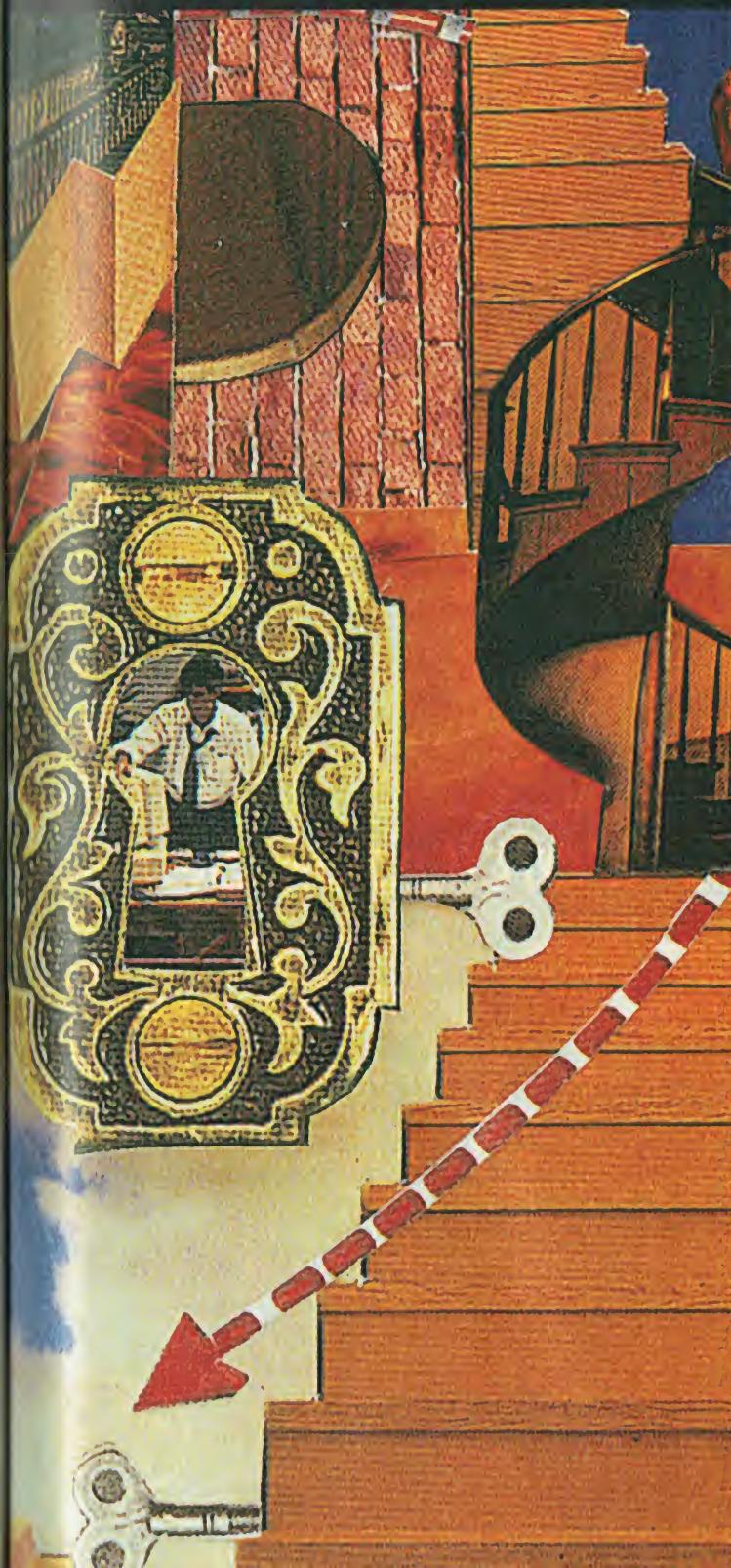
**BYTE:** *You've said you hope to increase the diversity of systems and footprints that NT will run on. Are we going to see with NT a similar model to Office, that is, a small business edition, professional version, enterprise version?*

**Allchin:** Yes. NT's small business server is a classic example of how the server family line will be extended. I'm sure you've heard about the enterprise version of NT; that's another example. So, the server family will get broadened, with one common kernel across them, but tailored for appropriate use. For example, in the small business case, we know there's only going to be one domain, so we don't have to ask the user a lot of questions. This way we can provide a much simpler end-user experience. On the client, you can expect to see the same thing. This scenario is different from the one for Win 95 and NT today in that these [NT] versions will be exactly the same system technology-wise. But they will be tailored to usage. There is a difference between whether you are running a system in an entertainment environment that you are using in your den and running a system at work. The key thing is that there will not be multiple versions of Windows, there'll just be Windows. But it will be tailored to the different environments.

*BYTE will print a more in-depth article, based in part on discussions with Allchin, in a future issue.*

# BYTE EXTRA

## INTERNATIONAL



### More Secure Digital Signatures

*Pen measures handwriting biometrics.* **Page 32IS 3**

### Companies Embrace Virtual Private Networks

*New VPN products make it easier to secure traffic on the Internet.*

**Page 32IS 7**

### Fast Ethernet Takes Off

*These 10/100 cards also offer compatibility with legacy networks.*

**Page 32IS 15**

### Speak Naturally

*Speech-recognition technology is becoming independent of speakers and languages.* **Page 32IS 19**

# *The Compact Power Performer...*



## *...LEO Databook Series*



### **LEO Safari 200**

Packing the functionality and performance of a conventional PC in an ultra-slim case, the **LEO Safari 200** has powerful networking and multimedia features that make it ideal for a full array of LAN, POS, edutainment and Internet applications.



### **LEO Safari Plus 200**

Combining the power and flexibility of a Pentium® processor-based PC with the simplicity of a traditional terminal, the **LEO Safari Plus 200** is the ultimate slim-line solution for today's increasingly networked corporate, school and home computing environments.



### **LEO Oasis 300**

Plug into the exciting new world of home multimedia computing with the **LEO Oasis 300**. From surfing the Web and sending e-mail to playing the latest multimedia games and managing the family finances - the **LEO Oasis 300** provides the supreme home infotainment center.



### **First International Computer, Inc.**

6F, FORMOSA PLASTICS REAR BUILDING 201-24, TUNG HWA NORTH ROAD, TAIPEI, TAIWAN

Tel: 886-2-7174500 Fax: 886-2-7182782

FIC WWW site: <http://www.fic.com.tw> E-mail: mkt@ss1.fic.com.tw

Specifications subject to change without notice. All trademarks used here in are the registered property of their respective owners. The Intel Inside and Pentium Logo are trademarks of Intel Corporation.

See us at  
**COMDEX FALL**

Las Vegas, Nov. 17-21, 1997

Booth No. L2462 (L.V.C.C.)

**Circle 451 on Inquiry Card**  
**(RESELLERS: 452)**



**pentium®**  
PROCESSOR

## Taiwan Gets Asia's First Satellite TV Service

*New Web-hosted multimedia magazines and data-enhanced TV programming are to come.*

**P**ay TV subscribers in Taiwan are among the first in Asia to receive direct-to-home (DTH) TV program services from digital TV satellites. Acer, Taiwan's largest computer company, recently released a satellite-based set-top box, and the company is working with Space TV Systems, a Sino-American program provider, to offer free Chinese programs over a satellite to the global Chinese community. Space TV Systems began operating in the U.S. market early this year.

Space TV Systems and Loral Skynet, which is a subsidiary of Loral Space & Communication in the U.S., have recently reached an agreement in which Space TV Systems will lease a 54-MHz Ku-band transponder on the Telstar-4 satellite to distribute Chinese TV programming throughout North America. The agree-



The next version of AcerStar will enable high-speed Internet access.

ment is valued at \$20 million over 10 years.

In Taiwan, Space TV Systems provides 80 channels of digital programming through a pizza-size satellite dish, remote

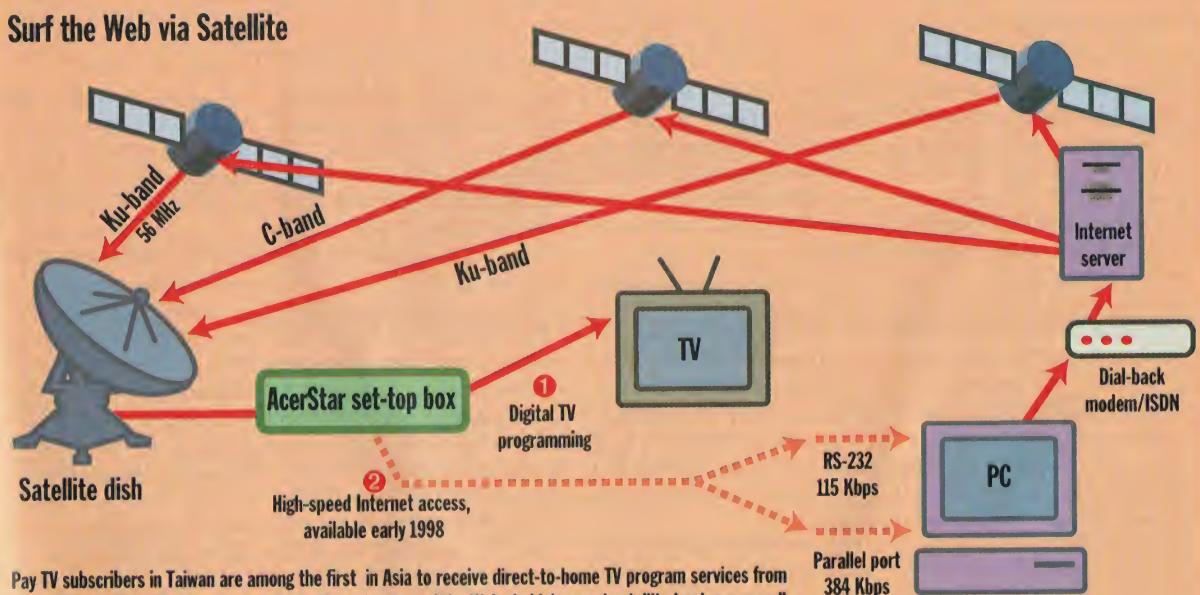
control, and the AcerStar set-top box with integrated decoder that connects to TV sets. The number of channels will increase to 160 in the first half of 1998.

The AcerStar set-top box uses a 32-bit Mips RISC processor and comes with an antenna system that receives up to three satellites simultaneously, the only one in the worldwide market. AcerStar is priced at \$350 without an antenna.

Also on the horizon are a new generation of home entertainment devices with integrated MPEG-2 and digital videodisc (DVD). To allow these functions, ever-sophisticated OSes will be added to run increasingly complex hardware.

In response to digital TV subscribers' need to upgrade to next-generation digital set-top boxes, the next version of AcerStar, due out by the end of the year, will let digital satellite TV subscribers surf

### Surf the Web via Satellite



Pay TV subscribers in Taiwan are among the first in Asia to receive direct-to-home TV program services from digital TV satellites. Early next year, they will be able to surf the Web via high-speed satellite hookups as well.

the Web via high-speed satellite hookups. The downstream path's bandwidth of the unit is up to 30 Mbps. By comparison, modems today download only 33 Kbps at best.

The broadcast content that users can now download includes digital high-res-

#### WHERE TO FIND

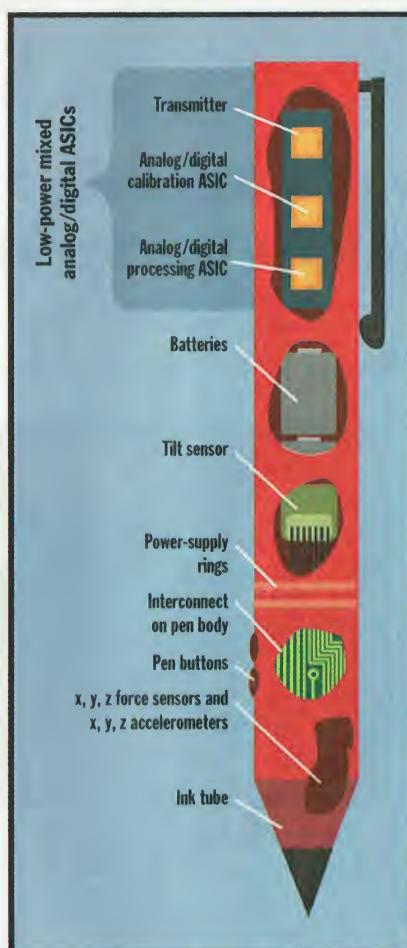
**Acer, Inc.**  
Taipei, Taiwan  
+886 2 545 5288; fax: +886 2 545 5308  
olivercheng@acer.com.tw  
<http://www.acer.com>

olution TV entertainment programming. The company will expand this to include broadcast Web sites, video-enhanced multimedia magazines, and data-enhanced TV programming.

—Stella Kao

## Make Digital Signatures More Secure

As digital signatures become increasingly important in electronic commerce, the LCI Computer Group (Hertogenbosch, The Netherlands) and the IMEC research center (Leuven, Belgium) have created a device that makes your handwriting eligible for authentication of electronic transactions. LCI-Smartpen, a ballpoint pen that writes on regular paper but is



Smartpen authenticates users through a signature's biometric characteristics.

wirelessly connected to a PC, authenticates users by the biometric characteristics of their signature.

Smartpen measures specific characteristics of signatures such as speed, acceleration, forces in three dimensions, and the angle under which the pen is held. It then calculates the exact 3-D trajectory of the ballpoint and stores it, including its dynamics as a token for later comparison. Says Roger van Overstraeten, the president of IMEC, "Smartpen stores the complete dynamics of a signature. That's why it is more secure than a [plain] written signature."

The device looks and feels like a normal ballpoint pen. However, it also houses a complete computer system, including acceleration sensors, a digital signal processor (DSP), a wireless transmitter, and a cryptography unit that secures data transmission between the PC and the pen.

Applications include electronic-commerce transactions and banking on the Internet, access to medical records, and

#### WHERE TO FIND

**LCI Computer Group**  
Hertogenbosch, The Netherlands  
+31 73 64 55255; fax: +31 73 64 55296  
<http://www.lcigroup.com>

also protection against credit-card fraud. Says Sam Asseer, CEO of LCI: "Issuing an electronic transaction on the Internet is now incontestable."

—Rainer Mauth

## Hand-Held PCs Wait for Localization

If you want to buy a Windows CE-compatible hand-held PC (HPC) in your local language, you may have to wait until the end of the year. Now, however, you can buy U.S. versions from manufacturers such as Hewlett-Packard, Philips, and NEC in some European countries. But file transfer between an HPC and a PC works only if you load a U.S. English version of the HPC Explorer synchronization software and Schedule+ release 7.0a on your PC.

The irony is, however, that some text files on the CD that ships with Windows CE 1.0 carry warnings saying that "serious problems" might occur if HPC Explorer runs on anything other than the U.S. English version of

Windows 95 or NT. Even if synchronization and file transfer between systems work reliably, this procedure replaces DLL files that other programs also use and may cause instabilities on the host machine.

HP, for example, which ships its 300LX and 320LX models in the U.K. and the Netherlands, says it issues a warning about potential incompatibilities to wholesale outlets and retailers in the respective countries. However, the question is, of course, whether this warning will come through to the end user.

Philips states it hasn't encountered any difficulties while synchronizing with other language versions of Windows 95. Never-

theless, the company is playing it safe. "We have decided to launch this version [1.0] of Windows CE in selected markets where we feel the English language is not a problem," says Philips' Miriam Vriens, who is a product-marketing manager.

Some users may accept the inconvenience of U.S. English applications on the HPC and potentially a mix of localized and U.S. English applications on the host PC, but how about support for special-character sets? For example, if you copy a German doc file to the HPC, will it retain the umlauts? Philips says its Velo HPC supports "easy entering of European characters." However, the current version 1.0 of the OS does

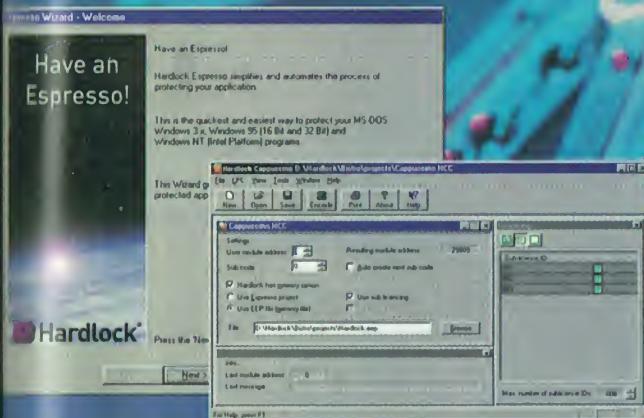
not support European character sets and data transfer may mean that some of the extended characters are not recognized and get dropped. (The final Velo version with this feature was launched in early September and couldn't be tested for this report.)

Currently, the only localization features of HP's models include the European date format and the currency symbol for the U.K. market. Says Barbara Wollny, spokeswoman at HP in Germany, "We will wait for Windows CE 2.0 for full support of local languages." According to Microsoft, version 2.0 will include support for several European languages and will ship in early December.

—Bob Emmerson

# ► Don't forget to lock your software before you leave.

Well Hardlock Bistro.  
The quick and easy way  
to protect your software.



Illegal software use costs software developers like you over \$13 billion each year. Hardlock helps you solve this

problem by guaranteeing licensed use of your products. And Hardlock now offers you unmatched ease-of-use, with exciting new features.

## ► Hardlock Bistro. The quick and easy way to secure your software.

The new Hardlock GUI, with Drag'n'Drop functionality, makes it easier than ever for you to use our wide range of protection tools, quickly and efficiently.



Hardlock Twin.  
State-of-the-art protection for demanding applications.



Hardlock E-Y-E.  
The worldwide standard for quality software protection.

## ► HL Crypt. Leading-edge security, adapted to your needs.

Our automatic protection system secures your application and any related data, in a matter of minutes. No access to the source code is necessary, making HL Crypt an ideal solution for software resellers. And HL Crypt's new advanced security features include support for 32-bit environments.

## ► HL LIMA. Flexible network license management.

Protect your network applications and offer your clients multiple site-licensing options. License single or multiple applications, modules and features. With our Remote Update Function you can even update licenses via the Internet.

The Hardlock Software Security System. State-of-the-art security – and easy to use.

## ► Order your Hardlock Developer's Kit today! Contact your local representative.

If your country is not listed, please call us directly:

FAST Software Security Tel: +49 89 89 42 21 37 Fax: +49 89 89 42 21 41 Email: [info@fast-ag.de](mailto:info@fast-ag.de)

**Argentina**  
HT-MACH Sistemas  
Electronics  
T (54) 1 795-8011

**Australia**  
Software Protection  
Systems  
T (61) 3 9544-4455

**Benelux**  
Aladdin Software  
Security Benelux  
T (31) 24 648-8444

**Brasil**  
HT-MACH Sistemas  
Electronics  
T (55) 21 257-0314

**Chile**  
Datasoft  
T (56) 2 246-7443

**Croatia**  
G & G Electronic  
T (385) 1 335398

**Czech Republic**  
EuroCAD  
T (42) 2 6610-7505

**Finland**  
FAST Finland  
T (358) 9 5495-0500

**France**  
Aladdin France  
T (33) 1 413 770 30

**Greece**  
FAST Hellas  
T (30) 1 600-4662

**Hong-Kong**  
Xitec Technology  
T (852) 2301-2340

**Spain & Portugal**  
FAST Iberica  
T (34) 1 754-1212

**Taiwan**  
New Solar Systems Group  
T (886) 2 633-5586

**United Kingdom**  
Aladdin Knowledge  
Systems UK  
T (44) 1753 622-266

**Korea**  
AC & P  
T (82) 2 736-4406

**Mexico**  
Sisoft  
T (52) 91 800 55283

**Philippines**  
Integrity Software  
T (63) 2 831-3112

**FAST**  
Software Security-Group

# If you really care for your software protect it.

## SMARTKEY THE INTELLIGENT SOFTWARE PROTECTION.

 **TOP SECURITY** makes it impossible to clone the key through the use of an ASIC chip.

 **TRANSPARENCY** also allows printers or other peripherals to be connected to the parallel port.

 **ALGORITHMIC INTERROGATION** gives a higher security level compared to fixed-answer type interrogation devices.

 **IDENTIFICATION CODE**, personalized for each user, is factory set on each key.

 **PROGRAMMABLE SECURITY CODES** can be user-programmed using the supplied utilities.

 **INTERNAL MEMORY** holding up to 416 bytes of read-write non-volatile memory.

 **DAISYCHAIN** enables up to 20 SmarteyKey and more to be installed on a same parallel port.

 **ANTIVIRUS FUNCTIONS** are implemented through the automatic encryption supplied.

 **DATA PROTECTION** is allowed through the encryption of data files associated with the protected applications.

 **COMPLETE SOFTWARE** is provided for manual and shell protection from DOS to WIN NT and UNIX.



# Eutron

COMPUTER SECURITY SOLUTION

EUTRON spa Bergamo  
Tel. +39-35-697011

e-mail [info@eutron.com](mailto:info@eutron.com)  
Fax +39-35-697092

Internet <http://www.eutron.com>

BRASIL - BELGIUM - BULGARIA - CROATIA - FRANCE - FINLAND - GREECE - HUNGARY - LUXEMBURG - POLAND - SLOVENIA - SWEDEN - THE NETHERLANDS

*And Your Country?*

Circle 437 on Inquiry Card (RESELLERS: 430)

# VPNs Proliferate

*As standards mature, new virtual private network products make it easy to secure traffic on the Internet.*

By Gerhard Kafka and Michael Kafka

**W**ithin the last two years, the Internet has evolved as the most popular network for on-line communication and information distribution around the globe. As the Internet increasingly becomes more reliable, corporate network managers are asking whether they can remove their traditional X.25- or frame-relay-based data networks and switch to the Internet as the corporate network infrastructure of choice. There are several compelling reasons to do so.

However, these network managers know that the Internet's openness and lack of security can be a nightmare. But the Internet provides a way to increase their companies' business and extend customer service over so-called Internet virtual private networks (I-VPNs) or extranets.

## Close to Customers

"An extranet links together various groups in and outside an organization," says Tom Kucharby, president of Summit Strategies, a marketing and channel-strategy consulting firm in Boston, Massachusetts. "Because companies are including customers and suppliers in their intranet projects, we think extranets will eventually make up almost 100 percent of the intranet market."

I-VPNs run over the Internet and transparently encrypt the links between sites.

They can provide a cost-effective way to connect small branch or home offices to a central office, to let partners access a company's internal network, and to securely trade and sell products. The advantages are obvious:

- Low access fees instead of high prices for leased lines.
- Excellent scalability of access, for example, from one Basic Rate Interface (BRI) ISDN line at 64 Kbps to 30 ISDN lines at 2 MBps via a Primary Rate Interface (PRI).

- Access is available worldwide via fixed and cellular networks as well as over satellite links.

I-VPNs use encryption technology to establish a *tunnel*, a secure transport channel, between sites. With client software to initiate the tunnel and a tunnel server at a corporate site to terminate the tunnel, your Internet service provider (ISP) doesn't have to support tunneling in any way. Both ends of the tunnel can

exchange IP or even IPX packets flowing from, for example, a remote site to a central-office LAN.

The tunnel acts as a router on top of the Internet protocol. If the target address of a packet points to a secure tunnel site, the tunnel server picks the appropriate encryption key, encrypts packets, and sends them off the Internet. At the destination, packets will then be decrypted. Encryption keys can be statically configured (i.e., each target tunnel uses its own key), dynamically exchanged through a public-key algorithm such as Rivest-Shamir-Adleman (RSA), or changed in regular intervals to further enhance security.

This kind of packet encapsulation has another advantage. Using network address translation (NAT), a LAN on one side of the tunnel can use a nonrouteable IP network address such as 10.0.0.0 (RFC 1918) internally. The IP tunnel will then translate this network address to a valid address for transport over the Internet. This prohibits an external computer from accessing an internal device, simply because every Internet router will drop packets with a destination of 10.x.x.x.

However, if you use Internet-routeable addresses internally, encryption of just the IP data fields still gives an eavesdropper access to IP addresses and port numbers, enough information



## Stronger Encryption

However, if you use Internet-routeable addresses internally, encryption of just the IP data fields still gives an eavesdropper access to IP addresses and port numbers, enough information

for an attack. That's why the packet, including the IP and TCP header, must be wrapped and placed in a new IP packet. (This is what tunneling is all about.) Such a packet is immune to manipulation if the encryption method used is strong enough.

Secure IP (IPSEC) is emerging as the standard used to coordinate encryption between two endpoints. It includes both Simple Key Management for Internet Protocol (SKIP), developed by Sun Microsystems, and Internet Security Association and Key Management Protocol (ISAKMP/Oakley) as optional protocols for key management. (For more information on tunneling protocols, see "A Virtual Private Affair," July BYTE.)

Key length of encryption algorithms is an important issue. Products typically have 128-bit key lengths in International Data Encryption Algorithm (IDEA) and RC4 algorithms or 112 bits in triple DES encryption schemes.

Several I-VPN products from European and Israeli vendors such as Data Fellows, Elvis+, Radguard, and Utimaco Safeware have entered the market. Many observers expect European companies to start building I-VPNs next year, though traditional VPNs will continue to play an important role throughout the next five years.

## Software Solutions

Data Fellows offers a full range of products based on the tunneling protocol SSH. "SSH is probably the most widely used communications-oriented encryption protocol," says Sakari Pihlava, a product manager with Data Fellows. "With our SSH implementation, we demonstrated

VPN vs. I-VPN				
	Cost	Security	Flexibility	Reliability
<b>Traditional VPN based on leased lines (Internet-independent)</b>	High	High	Low	High
<b>Internet infrastructure secured by firewalls</b>	Low	Limited	High	Medium
<b>I-VPN secured by firewalls and IP tunnels</b>	Low	High	High	Medium

that it was possible to develop a robust I-VPN product when other companies were only debating protocol standards."

SSH has been widely embraced as a remote log-in protocol in Unix applications. It includes direct support for SOCKS, an authenticated firewall traversal protocol, and uses RSA for host and user authentication.

"With the IPSEC standard coming along this year, we will show an IPSEC implementation of our VPN product this fall," notes Pihlava. He says that the new version of its F-Secure VPN product will use ISAKMP/Oakley for key management, because "this is where the early market will be." However, Pihlava also expects early ISAKMP/Oakley implementations in different products not to be 100 percent compatible and interoperability testing between products of different vendors to take until early next year.

F-Secure VPN runs on a dedicated Unix server using a 128- or 112-bit encryption

algorithm and supports Windows, Unix, and Mac clients. The software connects several LANs in a meshed topology, with separate IP tunnels from each VPN router to any other. It can also connect through a central VPN router in star topology. The F-Secure VPN router sits between the secure network and a Web server, providing firewall functionality. According to Data Fellows, a Windows NT-server version of F-Secure VPN, which will still be based on SSH, though, should also be available this fall.

A cheaper solution without a built-in firewall is the company's F-Secure SSH server and client software. With only one connection to the LAN, the SSH server acts as an IP tunnel proxy. It receives only encrypted traffic from the standard Internet access router, decrypts the packets, and sends them to the local client. You can establish secure connections from the client to the Internet via the SSH server or through the SSH client.

*continued*

## A Virtual Business Park

When secretaries at Siemens Nixdorf, Germany's largest computer manufacturer, need letterhead for the office, they point their Web browser at <http://www.Entropolis.de>, enter a password, log on to an office supply contractor's on-line store, and order the items they need. The completed order links directly to the contractor's transaction-processing system. The shipment and bill follow within 24 hours.

This is just a simple example of how closed user groups and extranets can improve customer ser-

vice and link business partners closer together. Users of the Entropolis virtual business park, set up by Advanced Services & Media, a subsidiary of Siemens Nixdorf, can form virtual common interest groups in financially separated malls. These malls may be public, or they may be accessible only to a closed group of users such as a trade association.

Entropolis interfaces directly with ordering and logistics systems from standard business process systems such as SAP's R/3 or Baan's Triton. Services include:

✓ Extranet presence with closed economic transactions between companies and their suppliers.

✓ Business-to-business transactions in vertical markets within a branch or a group of companies that share the same business interest.

✓ Business-to-consumer relation management where companies can directly offer their products in a personalized way.

The first two types of services may sound familiar to users of

Electronic Data Interchange (EDI) systems. However, services such as Entropolis or General Electric's Trading Process Network (TPN) in the U.S. are available to big and small vendors across markets. While the vendors of products typically pay a fee to the service provider, the buyers don't. (The cost of putting a company's product catalogs on Entropolis is between DM 40,000 and DM 80,000. In addition, suppliers pay about DM 7600 a month to rent space on the site.)

**-Valerie Thompson**



IBM's VisualAge for Java extends existing server apps to the Web without rewriting from scratch.

Work	Live
<a href="#">Home</a>	
<a href="#">Bike</a>	
<a href="#">Sail</a>	
<a href="#">Chris</a>	
<a href="#">Margarita</a>	
<a href="#">Read</a>	
<a href="#">Run</a>	

A black and white photograph showing a close-up of a person's feet and hands reaching upwards. The feet are bare, and the hands are partially visible, suggesting a sense of aspiration or reaching for something.

**Life is too short to spend rewriting code.** VisualAge for Java is the first enterprise-aware, incremental-compile development environment on the planet. It extends the 'write once/run anywhere' promise of Java to include 'Don't rewrite what's already there.' Instead, you visually program extensions to existing server data, transactions or apps — and VisualAge for Java generates the connectivity code to your Java clients. Seeing is believing. Visit [www.software.ibm.com/ad/vaj2j](http://www.software.ibm.com/ad/vaj2j), and see why the fastest way to the Web is also the fastest way to the beach.

**IBM**

Solutions for a small planet

The F-Secure Commerce server and client operate in a similar way but are optimized for use with standard commerce Web servers. The server authenticates a caller and establishes an encrypted connection between the browser and the Web server.

### Which Key Is Yours?

Utimaco's Safeguard VPN includes the server software, client agent, and a firewall. The agent software for Windows NT is based on Microsoft's Network Driver Interface Specification (NDIS) and oper-

ates between the NDIS hardware driver and the TCP/IP stack. Because this solution emulates a standard network API, it is transparent to the application. In the Unix version of Safeguard VPN, however, the agent is part of the TCP/IP stack.

Safeguard VPN includes an IP tunnel gateway with two LAN ports to include non-NDIS stations in encrypted communications. Developers can also use a Safeguard VPN software developer's kit to adapt existing applications to the tunneling environment.

Users can choose between 56-bit DES

and the stronger 128-bit IDEA algorithm for encryption. As for the tunneling and package signature, the system uses IPSEC tunneling to ensure interoperability with other vendors' systems.

Safeguard VPN uses SKIP or Strong Key Management and Authentication Protocol (SKAP), developed by Utimaco, for authentication and key management. SKAP implements the Generic Security Services API (GSSAPI) and supports RSA authentication via smartcards.

### Easy Setup

The stateless SKIP may be the best solution for small organizations, because it is easy to set up and doesn't require prior communication to establish and exchange encryption keys. It communicates keys in line with the packets. ISAKMP is better suited for large organizations or secure communication with business partners, because this session-oriented protocol allows for the negotiation of encryption schemes and thus makes integration of new sites easier. Companies who want additional authentication via smartcards will use SKAP.

Elvis+, a Russian network software developer, licensed its Secure VPN product to Sun in May. Sun is offering the VPN software in international markets as Sun-Screen SKIP E+.

Elvis+ Secure VPN uses SKIP for key management, but the company says it will eventually support the emerging ISAKMP standard as well. The company plans to include JMAPI-based (Java Management API) management of network objects in its product range and deliver the first JMAPI-compliant modules to its software early next year. Also, the company says its next versions will include support for user certificates stored on smartcards and a comprehensive development kit.

F-Secure, Safeguard VPN, and Elvis+ Secure VPN run the encryption process in software. Hardware-based solutions, on the other hand, offer performance advantages and usually depend less on OSes and the security holes that are associated with them. Although they often use proprietary tunneling schemes and are less flexible, they are sometimes considered more secure.

### VPN in a Box

Biodata's BigFire, a firewall packet filter and encrypting box, includes a proprietary IP tunnel. It provides three network

## Lantech Has Put Taiwan's Networking Industry Firmly On The World Map

Why Choose Lantech for All Your Solutions?

AI-UPS PRO With Safeware Plus  
AIP - 450 / 750 / 1050VA

It's very well made in Taiwan • 15 years of experience in Taiwan • Taiwan is Asia's 5th • Taiwan is Asia's 5th

International Office:  
Lantech Computer Company  
Tel: +886-2-766-7008  
Fax: +886-2-766-6892  
E-mail: [asiasales@mail.lantech.com.tw](mailto:asiasales@mail.lantech.com.tw)  
<http://www.lantech.com.tw>

United Kingdom:  
Lantech (UK) Ltd  
Tel: +44 (0) 1703 650999  
Fax: +44 (0) 1703 650999  
E-mail: [uksales@mail.lantech.net](mailto:uksales@mail.lantech.net)  
<http://www.lantech-global.com>

United States:  
Lantech International Inc. (USA)  
Tel: 1-818-3034299  
Fax: 1-818-3038177

Networking products were totally new in Taiwan when we entered the industry in 1986. We've come a long way since then, with sales in 1996 amounting to US\$20 million and expected to grow 50% this year. Our product line consists of a wide range of networking products as well as UPS and related monitoring/shutdown software. Five percent of our 120 employees are engaged in R&D, which is supported by 10% of annual revenues.

Their efforts are joined with partners in Taiwan and the U.S. to develop a host of new products such as print servers, SNMP stackable hubs, modular switching hubs, ISDN routers, and much more. The quality of all Lantech products is ensured by the use of Automated Testing Equipment (ATE), In Circuit Testing (ICT) devices, SGS auditing, and ISO 9001 approval of the entire plant facility. We're ready to serve you!



connections, one to the secure LAN, one linking directly to the Internet, and one that helps network administrators configure and operate the device. BigFire and BabylonNet, a dedicated tunneling server, use 112-bit triple DES as encryption algorithms. In addition, BigFire supports NAT and single-IP address resolution, which allows users to operate their complete extranet data transfer under a single-IP Internet address.

Radguard's NetCryptor, which extends the company's CryptoWall family of encryption products, lets you build multisite VPN solutions with central management facilities, a certification authority unit, redundant topologies, and automated messaging between the stations. Because the system includes a packet-filter firewall, it provides both security for the data traffic and protection against threat from the Internet. In contrast to BigFire, NetCryptor also supports IPSEC tunneling.

All the aforementioned solutions require software or hardware for both the client and the server. If you want your

WHERE TO FIND	
Advanced Services & Media Munich, Germany +49 89 636 50150 Fax: +49 89 636 50152 <a href="http://www.sni.de/public/media">http://www.sni.de/public/media</a>	<a href="http://www.datafellows.com">http://www.datafellows.com</a> Elvis+ Moscow, Russia +7 095 531 2503 sasha@elvis.ru <a href="http://www.elvis-plus.com/">http://www.elvis-plus.com/</a>
Biodata Burg Lichtenfels, Germany +49 6454 91200 Fax: +49 6454 1574 <a href="http://www.biodata.de">http://www.biodata.de</a>	Radguard Tel Aviv, Israel +972 3 6455444 fax: +972 3 6480859 <a href="http://www.radguard.com">http://www.radguard.com</a>
Data Fellows Espoo, Finland +358 9 478 4444 fax: +358 9 478 445 99	Strategic Networks Rockland, MA, U.S. <a href="http://www.summitstrat.com">http://www.summitstrat.com</a>
	Summit Strategies Boston, MA, U.S. +1 617 266 9050 fax: +1 617 266 7952 <a href="http://www.summitstrat.com">http://www.summitstrat.com</a>
	Utimaco Safeware Oberursel, Germany +49 6171 91710 fax: +49 6171 917112 <a href="http://www.utimaco.de">http://www.utimaco.de</a>

VPN to be transparent to the client, your ISP must have tunnel-enabled access servers and perhaps routers.

Big European ISPs such as EUNET, ECRC, and EBONE, for example, have already started to roll out security services for closed user groups as well as business-to-business commerce on the Internet. Closed user groups work best if all members access one provider's backbone and share a limited amount of network addresses. This allows the ISP to route and

filter data reliably and quickly, and avoids incompatibilities between the equipment of different ISPs. SAP, a big developer of enterprise resource-planning software, for example, runs its complete service and support network in such a closed user-group environment. **B**

*Gerhard Kafka and Michael Kafka are freelance writers who are based in Munich, Germany. You can reach them by e-mail at [gerhard\\_kafka@compuserve.com](mailto:gerhard_kafka@compuserve.com).*

## IT'S MORE THAN JUST A PLACE TO PARK YOUR DRIVES.

Now there is a way for you to get everything you need—data protection, increased performance, and a great price.

DPT introduces the RAIDstation3 kits, cost-effective Ultra and Ultra Wide RAID kits to secure data and increase performance for entry-level servers, or workstations running important, storage-hungry and performance-demanding applications like video editing, CAD or electronic pre-press. You get all the features normally found in expensive, high-end RAID subsystems, all for as low as \$1,249\*. Just add your own SCSI disk drives and you're *ready for RAID*.

You don't need to be a RAID expert to set up your system. With DPT's free RAID installation software, Storage Manager™, simply answer a few questions, click on the drives you want included in the disk array, and you're in business. Nothing could be easier!

Call us today and ask about our *one-time-try-it-you'll-like-it "Ultimate Deal"* on the new RAIDstation3 kit, or ask for the DPT reseller nearest you.

### Full-featured RAID Kits / **INCLUDE**

- PCI Ultra or Ultra Wide SCSI RAID adapter for superior performance
- Hardware RAID 0, 1 and 5
- 4MB of cache included, with room for up to 64MB of hardware cache
- Hot swap support for failed disk drives –
  - Automatic detection of failed drive
  - Remove failed drive without system interruption
  - Automatic spin-up of new drive
  - Automatic rebuild of the disk array
- Heavy duty metal cabinet construction
- Three lockable, hot-swap carriers for 3.5" half-height SCSI drives
- Power and disk activity LEDs
- Cabinet temperature monitoring
- Three year warranty
- Unlimited free technical support

B97101

**DPT**  
Distributed Processing Technology



140 Candace Drive, Maitland, FL 32751 USA • Tel: 407-830-5522 Fax: 407-260-6690 • [sales@dpt.com](mailto:sales@dpt.com) • <http://www.dpt.com>

# Organize your computers for easy access



Ergotron's **LANSCAPE™ Organizers** bring orderly equipment access to any network environment.

**Easy Access to Equipment.** Features such as open-backed work centers, Pull-out Tower Shelves, and lockable casters provide maximum accessibility to your equipment.

**Modular Design.** Customize your LANSCAPE Organizer from a comprehensive line of modular components. Interchangeable parts allow you to easily reconfigure as your needs change.

**Strength and Stability.** Modules can hold up to 2,000kg of hardware. In fact, the 152 and 183cm Server Shelves exceed ANSI/BIFMA furniture standards by over three times, and are also TÜV tested and approved.

**Hassle-Free Cable Management.** Ergotron's patented Quik-Touch™ cable management system means no wrestling with clumsy covers. One touch will open each of the individually hinged sections so you can quickly get at the wires you need.

**Long-Term Value.** LANSCAPE Organizers have a Lifetime Warranty on structural components.

**For a free catalog, call us today at +31 20 696.60.65**

 **ERGOTRON® inc**  
Engineered for the human factor

Ergotron Europa  
Eekholt 54, 1112 XH Diemen, The Netherlands  
Tel. +31 20 696.60.65 fax. +31 20 609.04.59  
<http://www.ergotron.com>



In order to facilitate diversified life in the multi-media, our R&D try harder to offer consumer-oriented peripherals of computer & optics including multi-functional CD-ROM, CD-R, DVD-ROM, color-catching Scanner. Leoptics says "Human touch is the way to lead high-tech life into the future".

Leoptics gets you there-  
Multi-media world

See Us At  
**COMDEX**  
Fall '97 Booth No. S4033f  
Sands Expo and Convention Center  
Upper Level  
November 17-21, 1997  
Las Vegas, Nevada USA

**LEOPTICS INC.**

8FL., No.283, Sec.2, Fu Hsing S.R.  
Taipei, Taiwan  
Tel:886-2-7550366  
Fax:886-2-7550380  
<http://www.leoptics.com>

Circle 458 on Inquiry Card (RESELLERS: 459).

# Fast-Forward to Fast Ethernet

*Dual-speed Fast Ethernet connects at 10 times the speed of conventional Ethernet while maintaining compatibility with legacy networks.*

By Stella Kao

**A**s the demand for increased network bandwidth surges, the market for high-speed LAN hardware—ranging from network interface cards (NICs) to hubs and switches—is now one of the most dynamic in the electronics industry. In previous years, higher-bandwidth applications pushed corporations to seek high-speed networking solutions. As a result, the demand for Fast Ethernet has been on the rise. But questions remain about Ethernet's future.

Last year proved to be a hype-only one for Fast Ethernet as the market generated few products. D-Link (Hsin-chu, Taiwan), which is one of the world's largest NIC manufacturers, estimates that its annual sales volume will grow to 3 million LAN adapters this year, but only one-sixth of them will be 10/100 Fast Ethernet cards. "It's going to take a long time for Fast Ethernet to achieve the 10Base-T volume," says Fred Chen, product manager at D-Link.

While network managers are taking steps to move to Fast Ethernet, they are also embracing switch-based topologies. Switch-based Fast Ethernet offers an attractive solution: It leverages the existing network infrastructure and usually complements legacy technologies. By dividing a network into smaller segments, it can provide a tremendous boost in overall network performance.

"As Fast Ethernet switches begin to break the \$100-per-port price point, switched desktop connections start to become a reality," adds Ching Yang Wang, vice president of marketing and product planning at D-Link.

Fast Ethernet, which handles data at 100 Mbps, is half-duplex and shared. Thus, if eight users are connected to a Fast Ethernet

hub, they share 100-Mbps throughput. But with a switched network environment using eight-port Ethernet switches, each user has 10-Mbps throughput, gaining a total data rate of 80 Mbps.

In addition, "Support for unshielded twisted-pair [UTP] and data handling by bus-master mode are crucial to the successful deployment of pure 100-Mbps Fast Ethernet," says Alex Chiou, director of the communications product division at Realtek Semiconductor. "Otherwise," he adds, "it will likely suck out all your CPU power."

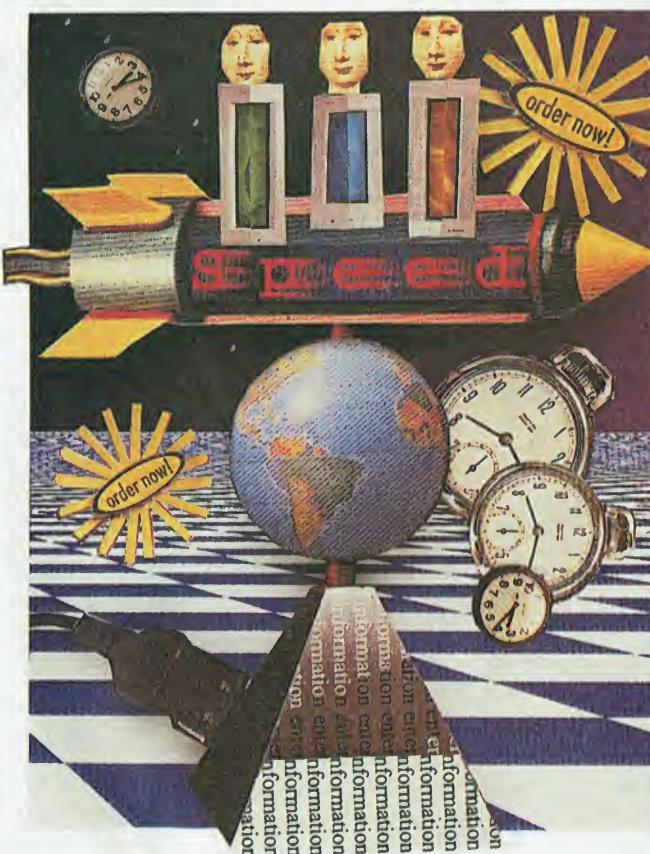
Cheng-Mau Chiou, marketing director at Acton, adds: "The increased use of Ethernet switches has deterred users from a total migration to 100-Mbps Fast Ethernet architecture."

## Anticipating Future Needs

So why bother to migrate to Fast Ethernet? Surprisingly, the overwhelming network density that exists today is not what's driving the move. Many businesses are moving to Fast Ethernet not to meet current bandwidth needs, but rather in anticipation of future requirements. Managers are concerned about the escalating bandwidth requirements of videoconferencing, video-based training, and the expected surge in peer-to-peer traffic as corporate Intranets grow.

Although bandwidth requirements have been a motivating factor, cost and ensured compatibility with legacy systems are also major considerations. Network managers have clearly opted for solutions that not only dramatically boost the data rate of their networks but also preserve the existing Ethernet frame, network design, traffic-management scheme, and cabling infrastructure.

The rapid emergence of low-cost combination 10/100-Mbps



NICs, hubs, and switches deserves credit for gradually swinging the market toward 100-Mbps technology. A big advantage of dual-speed Fast Ethernet is that it connects at 10 times the speed of conventional Ethernet while maintaining compatibility with existing 10-Mbps networks.

Although the price gap between Ethernet and Fast Ethernet products has narrowed considerably, "it's simply too great a stretch to leap up to Fast Ethernet," according to Eric Kuo, an associate vice president at CNet Technology. Considering the overall investment required, especially to renew the cabling infrastructure from Category 3 to Category 5 UTP wiring, most will choose to stay with dual-speed switching devices.

## Dual-Speed Fast Ethernet Cards

To ride the boom, network vendors in Taiwan have introduced a wealth of dual-

speed Fast Ethernet cards and switches that support both 10 and 100 Mbps. D-Link recently announced the D-LinkOffice switch, a 10-port Ethernet switching device that supports both 10- and 100-Mbps workgroups. According to the company, the device combines switching and Fast Ethernet technologies to provide increased bandwidth for data-intensive network applications.

Meanwhile, Accton's Fast SwitchHub-8s eight-port switching hub offers the greatest versatility for network configurations. Each port of the Fast SwitchHub-8s can be operated in either half- or full-duplex mode, achieving an aggregate bandwidth as high as 800 Mbps—80 times the bandwidth of a shared Ethernet network. With the Fast SwitchHub-8s, network administrators can upgrade workgroups to higher performance.

The PowerSwitch SH-1080 from CNet is a switching hub that has six 10Base-T

ports and two 100Base-TX ports. The hub provides a separate network segment on each port, greatly reducing collisions and increasing network speed. The device also provides SNMP support.

## Intel Lowers Prices

In an attempt to speed the adoption of the Fast Ethernet technology, Intel says it's seeking to remove price as a barrier to buying 10-/100-Mbps NICs. In February, the company dropped the prices of its 10-/100-Mbps LAN adapters from \$140 to as low as \$70—about the price level of 10-Mbps-only cards.

"With Intel's aggressive pricing action, it now makes sense for software developer to introduce applications specifically designed for Fast Ethernet networks," responds Realtek's Chiou.

In addition to increased market share, another motivation behind Intel's move is to push up sales of its high-power CPUs

## Single-Chip Solutions

To cope with Intel's game plan to lower prices and expand its presence in the Fast Ethernet market, many networking IC suppliers have been scrambling to introduce competing products that will enable hardware vendors to reduce their costs.

The chip makers' efforts started late last year, when AMD, Galileo Technology, and Texas Instruments unveiled a new generation of Fast Ethernet ICs. These chips promise to keep the price pressure on Intel by reducing chip count and speeding switch designs to market.

In an effort to cut the cost of entry-level, shared-media Fast Ethernet hubs, AMD has rolled out a single-chip, four-port repeater. The new Am79C730 integrated solution will enable hardware manufacturers to build an eight-port, 100Base-TX hub with just two chips. With this move, AMD, long a key player in the Ethernet IC industry, has successfully closed what was already a narrow gap between Fast Ethernet hub-port costs and 10-Mbps Ethernet switch-port costs.

Another contributor to the escalating price war, Galileo, has brought out its GT-48002 switched Fast Ethernet controller, which combines in a single device two full-duplex 100-Mbps Fast Ethernet controllers, a full-speed switching engine, a memory controller, and hardware network-management support.

Based on the company's ThunderSwitch scalable switching architecture, Texas Instruments' new TNETX3150 "switch-on-a-chip" integrates all the key components used in 10/100 Ethernet switch design onto a single IC, including a high-performance, 3.2-Gbps data-throughput engine, 12 10Base-T media access controllers (MACs),

and three 10/100Base-T MACs. Several Taiwanese companies, including Acer Netxus, a network start-up and a member of the Acer Group, have backed this new design.

U.S.-based companies are not alone in noticing network vendors' growing appetite for highly integrated Ethernet chips. Macronix International, Realtek Semiconductor, and Winbond Electronics all currently have future-generation models on the drawing board.

Realtek Semiconductor, an IC maker, has introduced a single-chip Fast Ethernet controller, the RTL8139, which operates at 10 or 100 Mbps. The company says that the RTL8139 is the first in a series of single-chip products. The single-chip switching engine integrates the MAC specification, physical chips, and a transceiver into silicon. Mass production will begin in October.

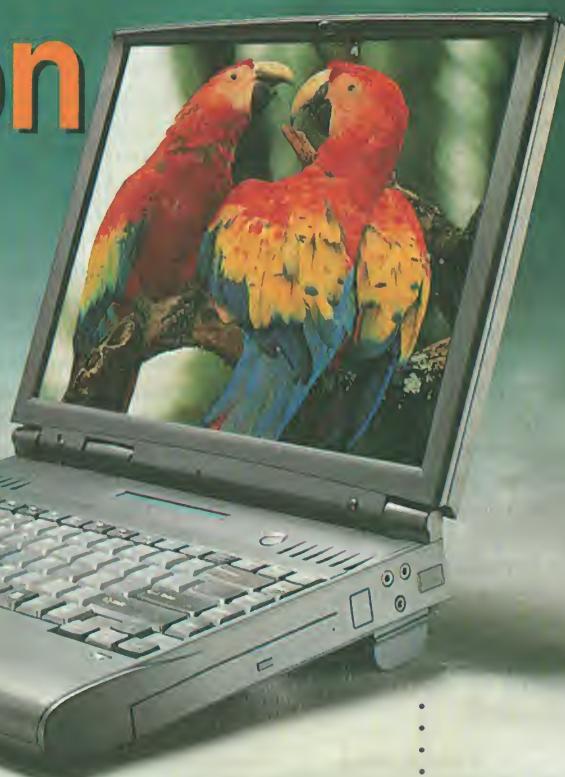
Meanwhile, Macronix is set to announce a family of two-chip 100Base-TX chips in the second half of this year. The company, which has set its sights on becoming the largest network IC supplier in Taiwan within the next year, is developing an all-Gigabit-Ethernet switch controller and a number of 100-Mbps switching hub ICs, all of which are scheduled to be launched in 1998.

The coming crop of highly integrated Ethernet ICs still must clear several technology hurdles. Ching Yang Wang, vice president of marketing and product planning at D-Link, says that it is not viable to integrate digital ICs with analog ones without sacrificing performance. Moreover, due to limits imposed by standard IC-fabrication processes, the yield rate is very low. "We found that it is not really more cost-effective to use a single-chip device—not for the near future," he explains.



Realtek Semiconductor integrates Fast Ethernet onto a single chip.

# Experience Innovation



## MITAC 5027 Has All The Bells & Whistles. And That's For Sure!

Not only is the system's unique battery design, full-sized keyboard, port replicator and 14.2" high-resolution LCD in a class of their own, this sleekly contoured machine also offers the best CPU performance on the notebook platform, ideal for today's executive. Supporting Intel® MMX™ microprocessor speeds of up to 233MHz, as well as up to 128MB of DRAM, a high-speed CD-ROM drive, IrDA and other speed-charged specs plus 3D surround sound, the system lets the user zap through multimedia

- applications like never before. What's more, its multipurpose bay and second battery provide top modularity and operating longevity.
- To put it simply, MITAC 5027 is the top portable system every professional would love to have. What about you?
- Check out this award-winning notebook at a MITAC office or associate near you. Alternatively, call, fax or e-mail us today and find out for yourself why BYTE named this dapper machine the coolest notebook at Computex, the world's third largest computer exposition.

## COMDEX Fall '97

November 17-21, 1997  
Las Vegas Convention Center  
Visit MITAC at Hall S-2, L2435

**MITAC**

Global Resources Serving Individual Needs

\* The Intel Inside Logo and Pentium are registered trademarks and MMX is a trademark of Intel Corporation.

\* Specifications are subject to change without notice.

Circle 449 on Inquiry Card (RESELLERS: 450).

MITAC INTERNATIONAL CORP. (TAIWAN) Tel: 886(3)3289000 MITAC USA INC. Tel: 1(510)6563333  
MITAC EUROPE LTD. (UK) Tel: 44(1952)207200/207300 MITAC JAPAN CORP. Tel: 81(3)5688 2446  
MITAC BENELUX N.V. (BELGIUM) Tel: 32(2)4610799 MITAC PACIFIC (H.K.) LTD. Tel: (852)25286782  
MS HARDWARE-SERVICE GmbH (GERMANY) Tel: 49(211)471970 MITAC NEW ZEALAND LTD. Tel: 64(9)2765124  
SYNTEX INFORMATION TECHNOLOGIES, INC. (U.S.A.) Tel: 1-800-7563888 SYNTEX K.K. (JAPAN) Tel: 81-3-5688-2340  
SYNTEX AUSTRALIA PTY. LTD. Tel: 61(3)95400595 SYNTEX UK Tel: 44(1952)207200/207300  
E-mail: market@smplink.mic.com.tw (URL): http://mitac.mic.com.tw/

and chip sets. Because bigger pipes need more processing power to fill them, the price cut should ultimately benefit Intel's primary microprocessor business, many network vendors say. Unwilling to see their market share drop, NIC leaders such as 3Com and Cisco are now forced to dramatically cut their prices to match Intel's.

Falling prices for Fast Ethernet are also evident in switches and hubs. Early this year, NIC leaders reduced prices for Fast Ethernet hubs to as little as \$65 per port, putting them in head-to-head competition with 10-Mbps Ethernet switches, which cost \$70 per port. In addition, some vendors claim to have broken the \$100-per-port barrier for 10/100 Fast Ethernet switches.

Accton is expected to make a splash this month with the announcement of a new line of low-cost switch devices based on TI's ThunderSwitch single-chip controller. Moreover, Accton says that its new 24-port 10-Mbps switch, which should be available in the second half of this year, will lower the per-port price to less than \$50—the lowest in the world, the company claims.

## Gigabit Ethernet on the Desktop

As newcomers continue to flood the market with prestandard gigabit-speed Ethernet networking hardware, the Gigabit Ethernet technology is expected to be the next-generation pipe for connecting PCs and servers over a local network.

Targeted at backbone environments for switched Ethernet segments, Gigabit Ethernet is designed to move data across a network at 1000 Mbps using conventional Ethernet frames. As a logical upgrade path for bandwidth-hungry applications, such as imaging, animation, MPEG, Internet/intranet, videoconferencing, and CAD/CAM, the Gigabit Ethernet proposal builds on the established capabilities inherent in 100-Mbps Fast Ethernet and Fibre Channel technologies.

In an attempt to gain recognition with potential customers and possible suitors, start-up companies that focus on this emerging market have debuted various Gigabit Ethernet gear. But sales volumes thus far have been low.

One obstacle to the acceptance of this

ultrahigh-speed technology is the lack of a finalized standard. But the Gigabit Ethernet Alliance, a group originally made up of 104 vendors developing open and interoperable Gigabit Ethernet solutions, has grown to hundreds of members. Plans are proceeding toward an official IEEE 803.2z standard in the first quarter of 1998.

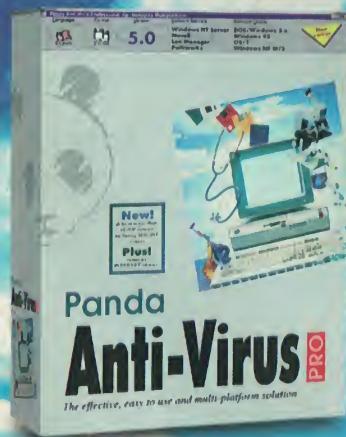
This standard builds on traditional Ethernet functionality. Most important, it will allow backward compatibility with 10Base-T and 100Base-T technologies.

"The best thing about Gigabit-speed Ethernet is that network managers don't lose any of their installed equipment or their investment in training," says Chi-Houn Ma, design manager at Macronix International. Since the physical layer is borrowed from Fibre Channel, manufacturers are expected to develop products that offer simple Gigabit Ethernet full-duplex uplinks, implemented as PCI cards in servers or switches.

CAD/CAM designers and engineers are early adopters of this technology. But this situation will slowly change. "Eventually, Gigabit Ethernet will become a reality to compete on the desktop, but you're looking out three years," Ma notes. In the initial deployment process, Gigabit Ethernet will likely act as a speedy backbone solution, where it will function as the pre-

# The Network Anti-Virus experts

Netware, NT, Banyan, Pathworks, Lan Manager...



### Client / Servers Platforms Supported

Netware	Win NT	DOS	Windows	Win 95	Win NT WIS	OS/2
✓	✓	✓	✓	✓	✓	✓

★ Distributor inquiries welcome

★ Bundles for OEM & Integrators



Visit our **Web Site**  
to obtain your  
**Evaluation Copy**  
[www.pandasoftware.com](http://www.pandasoftware.com)

Germany 49 4203 81277 • France 33 1 39743493 • UK 44 181 3909911  
• Denmark 45 42 481984 • Portugal 351 1 3864376 • Romania 40 68  
410420 • Cyprus 357 2 313860 • Greece 30 1 6712153 • Lithuania  
370 2743961 • Argentina 54 21 824275 • Brazil 55 11 8223462 • S.A.  
Domingo 1809 5976867 • Morocco 212 2 275542 • Tunisia 216 1  
840526 • U.A.E. 971 2 779387 • Colombia 57 1 6108308 • Finland  
358 3 222 9997 • Sweden 46 8 611 66 44 • Italy 39 2 242021

**Panda**  
Software International

Avda. de la Democracia, 7 - Pl. 3 nº 7  
28031 MADRID - SPAIN  
Tel: 34 1 301 30 15  
Fax: 34 1 332 00 54  
E-mail: [info.intl@pandasoftware.es](mailto:info.intl@pandasoftware.es)

### WHERE TO FIND

Accton Technology Corp.  
Hsinchu, Taiwan  
+886 3 577 0270  
fax: +886 3 578 8102  
<http://www.accton.com>

CNet Technology, Inc.  
Hsinchu, Taiwan  
+886 3 578 6666  
fax: +886 3 578 2458  
<http://www.cnet.com.tw>

D-Link Corp.  
Hsinchu, Taiwan  
+886 3 577 9966  
fax: +886 3 577 7145  
<http://www.realtek.com.tw>

ferred link between switches that connect to lower-speed Ethernet components.

D-Link's Wang adds: "You're going to see ATM and Gigabit Ethernet in WANs; that's where the technology is going to be applied first." **B**

*Stella Kao is a BYTE contributing editor in Taipei. You can reach her by sending e-mail to [meou@email.gcn.net.tw](mailto:meou@email.gcn.net.tw).*

# Speak Naturally

*Speech recognition technology is becoming independent of speakers and languages.*

By Tania Hershman

**M**achine recognition of continuous, real-world speech has been one of the most complex challenges faced by linguists and software developers. However, several new packages coming to market this year, from companies such as Dragon Systems, IBM, Lernout & Hauspie, and Philips, can deal with normal speech, recognizing up to 200 words per minute. "Speaking speed is no longer an issue. How fast can you think?" says Melvyn Hunt, managing director of Dragon Systems U.K.

There will never be an exact match between two spoken words. Even one person doesn't say the same word in the same way twice. Speed, emphasis, and length of the pronunciation all vary depending on context but also on the speaker's emotional situation, making speech recognition a complicated task for developers.

Continuous speech dictation software has been available for the last 18 months but has been limited to around 25,000 words and profession-specific vocabularies, such as for radiologists (e.g., IBM's MedSpeak). Now continuous systems such as Dragon's NaturallySpeaking are starting to replace existing systems that usually work only with discrete speech punctuated with pauses or that are limited in vocabulary.

Simply put, these new systems do the same as humans do, albeit primitively. They separate speech into words or phonemes (the basic building blocks of speech), compare the acoustic patterns of the speech with the patterns stored in a database, and find the most likely word.

General-purpose dictation software such as Dragon Dictate, IBM VoiceType, and Kurzweil AI Voice typically come with up to 60,000-word vocabularies and the ability to add new words. However, they cannot cope with input at natural talking speeds (limited to about 100 words per minute), and they require the

user to punctuate sentences with short pauses. They usually "understand" straight out of the box, although they work better when given the chance to adapt to a regular user's speech patterns and learn frequently used words.

Today's dictation software, when adapted to a user's speaking characteristics and optimized for certain contexts, achieves around 95 percent accuracy. However, the ultimate aim is for all systems to be speaker-independent and multilingual.

Dragon's new NaturallySpeaking, one of the first general-purpose continuous speech dictation packages, is an example of software that heralds the next generation in computer dictation. Although the first version doesn't allow the speaker to dictate into other applications, you can paste recognized text into other software. Also, it does not include the command-and-control features that come with some discrete dictation packages for vocally navigating around the computer, opening and closing applications, and even surfing the Net hands-free.

Processing natural speech eats up a lot of computing power, and this is one reason why it has taken until now for viable commercial products to hit the shelves. "When our first system was developed in 1993, the processor power of a PC was not sufficient to run natural continuous speech recognition," says Ralph Preclik, communications director of Philips Speech Processing. "We had to develop a dedicated accelerator board at that time."

With the introduction of Pentium Pro and MMX technology, speech recognition applications are now running straight from the CPU without a dedicated DSP to perform the signal-processing analysis. According to Preclik, the bottlenecks in speech recognition are now related to other factors; for example, the insufficient display speed of word processing applications.

*continued*



Most new (and also many earlier) speech recognition applications not only require high computing power but also a minimum of 32 MB of RAM. However, in an embedded-system environment such as a mobile phone, algorithms have to get along with much reduced system resources and perform one- or two-word recognition at best.

Speech recognition algorithms that identify your utterances as a sequence of whole words are usually very fast. But they require more training and greater processing power. Therefore, they apply very well to small-vocabulary applications such as command/control or hands-free phone dialing.

On the other hand, algorithms that recognize phonemes, the basic building blocks of spoken language, are usually

more compact and flexible. Phoneme-based algorithms allow for the addition of new words to a vocabulary by identifying and combining existing phonemes. (Most languages have between 30 and 60 phonemes, so the number of combinations is huge but manageable.)

An automated directory-inquiry system, which can retrieve, for example, a name without linguistic context, is a typical application of phoneme-based algorithms. Phonetic Systems' Phonetic Database Server, for example, uses such algorithms for speech recognition and rapid searching of very large databases. It can currently handle databases containing 100,000 names, but the company aims to have search capabilities of one million entries by the middle of next year.

Both types of algorithms reinterpret the

signal phonetically and match it with its database of acoustic samples by allotting probability scores to possible word matches. Hidden Markov Modeling, based on a two-stage probabilistic process, is currently the most popular statistical modeling technique used for allotting such scores. Alternative models that use neural networks do not perform as well as Hidden Markov Models (HMMs). Says Philips' Ralph Preclik, "Today neural nets can gain acceptable performance only in combination with HMMs."

Acoustic matching produces the most likely phonemes or words, but this is not the end. Words can be spoken in different ways, at different speeds, so intelligence is needed to make the leap from a combination of phonemes into actual words or sentences. This process is called linguis-

## The GlobalPhone Project

Tanja Schultz, a German computer scientist, hopes to break down some language barriers when she finishes her Ph.D at the University of Karlsruhe. She is working on a multilingual speech recognition system—called GlobalPhone—that could provide access to information regardless of the speaker's language. Professor Alex Waibel, who leads the speech recognition groups at Karlsruhe and at Carnegie Mellon University in the U.S., supports the project.

"The user will be able to speak to the system in his native language, and the system will decide what language was spoken and

recognize the input," Schultz says. After GlobalPhone has identified the language and recognized a user's speech or commands, it will be able to turn the content into text, then translate it or rephrase it as synthesized speech.

The goal of the project is to emerge with a system that recognizes any one of the 12 most widespread languages. English, French, and German linguistic databases are already available. In addition, the GlobalPhone team has collected high-quality databases of samples in Arabic, Chinese, Japanese, Croatian, Korean, Portuguese, Russian, Spanish, and Turkish.

For each language, the GlobalPhone researchers asked about 100 native speakers to read 20 minutes of newspaper text. They recorded each session digitally and characterized the recording session for each person by speaker characteristics and environmental conditions.

"The data collection is now done," says Schultz. The next step will be the training of the recognition engine based on the collected acoustic samples.

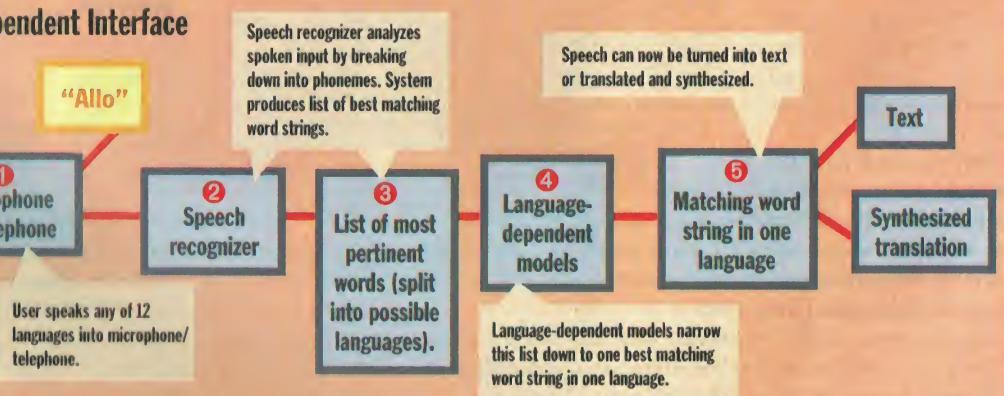
The GlobalPhone engine uses a phoneme-based algorithm, and its dictionary contains all known words from each language in a multilingual phoneme set. "Our

phonemes are no longer language-specific but shared by several languages," explains Schultz.

When up and running, the GlobalPhone engine will produce a list of the most pertinent word strings separated into different languages. A scoring procedure will then reduce the number of best words and result in a best-matching word string. Schultz expects to have a running version with this functionality next spring.

The number of potential applications is huge. It includes any sorts of multilingual information and ordering systems, automatic telephone operators, or translation services.

### Language-Independent Interface



## GENERIC OCX's & DLL's

### Comms - Asynch

CommTools-DLL	£215
Greenleaf CommLib 5.2 (DLL)	£235
Max Comm Objects Pro	£345
Internet	
Distinct Visual Internet Toolkit	£242
Socket OCX 1.6	£70
Max Webster OCX (32-bit)	£110
SocketTools	£175

### Database

Classic Data Control for Btrieve	£175
CodeBase 6.2 (Unlimited-Client)	£295
Crystal Reports Pro 5.0	£285
Report FX Enterprise	£240
Report FX/Charl FX Bundle	£325

### Graphics - Charting

Olecrat Chart	£247
Chart FX Enterprise 3.0 (16/32)	£247
First Impression OCX 2.1	£204
Graphics Server 5.0	£235

### Graphics - Sundries

Autodesk Redlining OCX32	£999
Barcode OLE 2K (16/32-bit)	£145
Graph for Windows	£189
Pic 4.0	£196
GeoPoint	£204
ImageGear Std ActiveX 6.0	£1250
ImageMan ActiveX Suite 5.0	£322
InterAct	£275
LEADTOOLS ActiveX16/32 Pro	£375
VectorFX	£229
Vector Image Proc for Win32	£390

### Grid Controls

Data Widgets 2.0	£99
DataTable Pro 3.1 (16 & 32-bit)	£265
Formula One OCX 4.0	£204
Spread 2.5	£220
True DBGrid	£195

### Multi-Function

Designer Widgets 2.0	£99
VideoSoft VSView/OCX	£119

### Multi-Media

FXTools Professional 4.0	£240
Light Lib Multimedia PRO	£335
Light Lib Multimedia Standard	£185

## LOW PRICES FOR MICROSOFT & BORLAND PRODUCTS

Visual Basic Prof 5.0	£378
Visual Basic Enterprise 5.0	£918
Visual C++ 5.0 Enterprise	£919
Visual C++ 5.0 Professional	£377
Visual C++ 5.0 Learning Edition	£72
Visual Studio 97 Professional	£765
Visual Studio 97 Enterprise	£1125
Delphi Standard	£67
Delphi Professional	£389
Delphi 3 Standard	£81
Delphi 3 Professional	£382

### WITH FULL TECHNICAL SUPPORT

## DELPHI

Delphi 3 Standard	£81
Delphi 3 Professional	£382
Delphi 3 Client/Server	£1337
Delphi (Delphi 32 & 16)	£245
Delphi (Delphi 32 & 16)	£225
Delphi 2.02 for Delphi	£110
Delphi HAD Pack for Delphi	£125
Delphi Tools for Win - Delphi	£164
Delphi Create	£162
Delphi's Suite NetWare 5.0	£351
Delphi PRO	£210
Delphi Power Controls 2.0	£135
Delphi Hand 3.0	£104
Hyper-HTTP/Pro	£320
Hyper-DB Win32&Win16	£109
Hyper-View 3.0	£159
Hyper-View Multilanguage Std 2	£144
Hyper-View Multilanguage Pro	£685
Hyper-Splntr Pro	£84
Hyper-Labels for Delphi 4.0	£295
Hyper-Draw Kit	£99
Hyper-Splntr Pro	£105
Hyper-Splntr Expert	£195
Hyper-2.1 (32 & 16-bit)	£110
Hyper-Project Manager 2.0	£86
Hyper-Tune Graphics Tools	£300
Hyper-Tune	£98
Hyper-Component Expert	£125
Hyper-Standard	£164
Hyper-OS 1.1	£125
Hyper-Print Kit	£99

## GENERIC OCX's & DLL's

### Sundry Controls

Calendar Widgets	£99
Input Pro	£110
Schedule/OCX	£177
Sentry Spell-Checker Engine	£235
StorageTools 1.0	£92
Tab Pro 2	£99
TList Pro OCX	£174
VersionStamper 5.0	£106
VisualSpeller OCX 2.0	£102
VideoSoft VS-OCX	£87
VideoSoft VSFlex/OCX	£119

### Text Editor Controls

ALLText HT/Pro OCX	£305
HighEdit Pro	£399
TX Text-Control Collection OCX	£195
VisualWriter Pro OCX 3.0	£204

## C & C++ FOR WINDOWS

### Comms

COMM-DRV/LIB 16.1	£124
Fax C++ SDK for Win16/95	£905
Greenleaf CommLib 5.2	£235

### Compression

Crusher! Win 16-bit w/Source	£225
Greenleaf ArchiveLib 2.1	£210
PKWare Data Comp Lib Win32	£225

### Database

CodeBase 6.2	£295
DISAM96 for Win95	£715
ProtoGen+ Client/Server Win	£1370
ProtoGen+ Pro	£345
Rainia DBM Engine+EADS 4.0	£740
Report Writer Visual Coder	£75
Velocius + EADS (Offer)	£250
Visual SQL	£958

### Graphics - Charting

Charting Tools for Win	£164
Essential Chart for Win	£275
GraphicWin 7.0	£360
Graphics Server 5.0	£235
Olecrat Chart	£247
Real-Time Graphics Tools	£300

### Graphics & Images

Ad Oculos 32- & 16-bit 3.0	£475
ImageMan DLL 32 & 16-bit 5.0	£517
LEADTOOLS Win32 Pro	£690

### Graphics & GUI

3d Graphics Tools 5 (32-bit C)	£209
WinGKS	£575
Zinc Engine & Win32 Key 4.2	£658

### Modula-2

Modula-2	£100
----------	------

### Pascal

Pascal	£100
--------	------

### Smalltalk

Smalltalk	£100
-----------	------

### Version Control

Version Control	£100
-----------------	------

### Windows

Windows	£100
---------	------

## BASIC LANGUAGE

PowerBASIC DLL Compiler	£106
XBasic Pro (Win32)	£493
VisualAge for Basic	£80

Circle 441 on Inquiry Card.

# GREY MATTER

Price Matching, Arbitration, Delivery, Tolls, etc.

Prices do not include VAT or other local taxes but do include delivery in mainland UK.

Please check prices at time of order as ads are prepared some weeks before publication.

This page lists some of our products - call us for a complete price list.

ORDER BY PHONE WITH YOUR CREDIT CARD

**(01364) 654100**

FAX: (01364) 054200

www.GreyMatter.co.uk

mailto:desk@GreyMatter.co.uk

## News & Views

### JBUILDER

Borland's RAD Java Tool Is Here!

Borland's long-awaited JBuilder is finally here, with full JDK 1.1 and Beans support.

■ **BeansExpress** is the fast way to create Beans - just point and click!

■ **RAD Workbench** with visual component palette, browser, project manager, visual designers, two-way tools, editor, debugger and lightning-fast compiler

JBuilder Professional adds all that you need to create robust database applications, including:

■ **Java Beans Component Library** includes over 100 Beans including grid & other database components with full source code

■ **Local InterBase** for off-line SQL development

Check our web site for full details

## VISUALAGE FOR JAVA

The Best Visual Designer on the Planet?

IBM's VisualAge for Java goes head-to-head with JBuilder, with full Beans support and IBM's award-winning visual programming paradigm:

■ **Visual Composition Editor** builds applets, apps & beans visually from beans on the palette

■ **Incremental Compiler** lets you modify code while debugging it

■ **Repository-Based IDE** stores projects as classes & methods keeping track of all source code changes automatically

■ **Enterprise Edition** adds built-in team management support and automatic beans generation for connections between Java clients, SQL databases & transactions

## WISE INSTALLATION SYSTEM ENTERPRISE EDITION

### Installer With Unique Features

The Wise Installation System includes all the features you would expect from an installation program, and the Enterprise adds the following unusual features:

■ **SmartPatch** creates installations that will upgrade previous versions of software or datafiles without having to ship an entire new copy

■ **WebDeploy** allows for true Internet installations of your software using a 90KB executable that downloads the required files via WinSock

■ **SetupCapture** creates customisable installations from existing ones

## HACKSAW

### The Ultimate WebMaster's Utility

Hacksaw is a very useful command-line tool for Web administrators. It can retrieve files & headers from HTTP servers; send email to SMTP servers; check, retrieve & delete email from POP3 servers, and has many very powerful functions for dealing with FTP servers. It can be used interactively or activated by a scheduler program. This product is must for any **serious professional Web Master**. Don't take our word for it - download it from our web site before you register it. £20 + VAT

## VISUAL BASIC 5

Don't forget that Visual Studio 97 includes the equivalent edition of Visual Basic 5 as well as Visual C++, Visual J++, Visual FoxPro & Visual InterDev

- better value for many developers, especially the Enterprise

Visual Basic Enterprise 5.0 £918  
Visual Basic Professional 5.0 £378  
Visual Basic Learning 5.0 £70  
Visual Studio 97 Professional £1125  
Visual Studio 97 Enterprise £765

tic matching. The speech engine then emerges with what it considers to be the most likely word that was spoken.

## Multiple Languages

The Holy Grail of computer linguists is a language-independent, speaker-independent, continuous speech recognition interface. Lernout & Hauspie's Language Factory, a software development kit (SDK), helps developers move closer to this paradigm. This suite of multilingual, speaker-independent technologies—which includes components for automatic speech recognition, text-to-speech conversion, translation, and digital speech compression—is tailored to small and medium vocabularies. It has already been implemented in a variety of areas, such as language-learning software, voice verification systems, and car navigation.

Lernout & Hauspie's SDK probably has the widest range of supported languages. Its products are available in U.S. English, U.K. English, French, German, Italian, Cantonese, Dutch, Korean, Malay, and Spanish. Japanese, Mandarin, Portuguese, and Russian versions are currently under development.

Building a speech recognition engine in multiple languages requires a lot of resources because you need to collect a large database of speech samples first, including all accents, dialects, and the unique sounds in that language. "This is quite a lengthy process, not least because you must have recordings of several hundred speakers to be able to produce a good

## The Ultimate User Interface

**S**tar Trek had it right: Speech is the best user interface. We're starting to see innovative applications that use speech to turn on and off the lights in your house, for example, or to tie all your inboxes together and give you access to their contents from a remote phone, or to replace touch-tone phone commands and menus.

Registry Magic Virtual Operator, from Registry Magic, is a new office automation tool that can answer and direct calls without an operator. A bank can program it to check a customer's balance after it matches a verbal password to their stored voiceprint.

Keyware Technologies recently released a software

development kit that will allow system integrators and value-added developers to create software verification applications based on Voice-Guardian software technology. The SDK provides an API for voice verification using a dynamic link library, ActiveX control, or Windows NT service. This API can be used to construct secure stand-alone or client/server applications. It also includes sample programs for a voice-secured Web site.

The company also sells an application that combines both facial and voice verification technologies in a single integrated security system. Called Keyware S<sup>2</sup> Security Server, the system matches facial and vocal

input against a centrally stored user profile. In highly sensitive or classified areas, a special input station could prompt a user for a password while capturing a facial image and asking that the user speak an ID into a microphone.

And on the home front, you can now control almost every appliance in your house from anywhere in the world. A program called HAL2000, from Home Automated Living, provides interactive control of your domestic domain through continuous speech recognition technology. You just speak naturally to your appliances. Household appliances are controlled using X-10, RF, or infrared devices.

model," says Richard Winski, manager of language resources and technology at Vocalis Group. "With access to a suitable database, however, you can normally add a new language in a few weeks."

Each new language presents a unique challenge. "You have to devote a lot of resources to the peculiarities of each language," says Hunt of Dragon Systems U.K. English, for example, is difficult to syn-

thesize because pronunciation is not always obvious from the way a word is spelled. French, on the other hand, is more difficult to recognize. The French verb *appeler* (to call), for example, can be spelled 12 different ways yet pronounced identically. In German, compound words are difficult to deal with, and the various Chinese dialects differ largely in tone, which isn't an issue in European languages. A case in point is the Chinese word *ma*, which can have five different meanings, depending on intonation.

One of the first companies to rise to the Chinese language challenge was Motorola's Lexicus division. Discrete speech recognition software has been very difficult for Chinese because word boundaries are sometimes ambiguous. As a result, speedy recognition in Chinese wasn't possible until continuous systems worked well enough. Motorola's Chinese continuous speech recognition engine, released late last year, can now recognize over 10,000 spoken words running on a standard PC. That's good news for the 20 percent of the world's population that speaks Chinese. ■

### WHERE TO FIND

**Dragon Systems**  
Bishops Cleeve, Cheltenham, U.K.  
+44-1242-678-575  
fax: +44-1242-678-301  
info@dragonsys.com  
<http://www.dragonsys.com>

**GlobalPhone Project**  
Karlsruhe, Germany  
+49-721-608-4735  
tanja@ira.uka.de  
<http://werner.ira.uka.de/~tanja>

**Home Automated Living**  
Burtsville, MD, U.S.  
+1-301-879-2305  
fax: +1-301-384-8275  
info@AutomatedLiving.com  
<http://www.AutomatedLiving.com>

**Keyware Technologies**  
Brussels, Belgium  
+32-0-2-721-4574  
fax: +32-0-2-721-5015  
<http://www.keyware.be>

**Kurzweil AI**  
Waltham, MA, U.S.  
+1-617-893-5151  
fax: +1-617-893-6525  
Info@kurzweil.com  
<http://www.kurzweil.com>

**Lernout & Hauspie**  
Ieper, Belgium  
+32-57-228-888  
fax: +32-57-208-489  
sales@lhs.be  
<http://www.lhs.com>

**Motorola Lexicus Division**  
Palo Alto, CA, U.S.  
+1-650-494-0800  
fax: +1-650-494-1141  
danab@lexicus.mot.com  
<http://www.mot.com/MIMS/lexicus>

**Philips Speech Processing**  
Vienna, Austria  
<http://www.speech.be.philips.com>

**Phonetic Systems**  
Petach Tikva, Israel  
+972-3-921-0905  
fax: +972-3-921-0966  
jerry\_p@phonetic.co.il

**Registry Magic**  
Boca Raton, FL, U.S.  
+1-561-367-0408  
fax: +1-561-367-0608

**Vocalis Group**  
Cambridge, U.K.  
+44-1223-846177  
fax: +44-1223-846178  
enquiries@vocalis.com  
<http://www.vocalis.com>

Tania Hershman is a freelance writer based in Jerusalem. You can contact her by sending e-mail to [t\\_hersh@netvision.net.il](mailto:t_hersh@netvision.net.il).

# What's New

## Hardware

*A low-cost, high-capacity tape drive, and an easier way to navigate between Web sites.*

### PREVIEW



**Eagle DM-1**  
around \$500

Enter 1014  
on Inquiry Card.

**Exabyte Corp.**  
Utrecht, The Netherlands  
+31 30 245 8800  
fax: +31 30 258 1582

### A Tape Drive for MPEG-2 Streams

Exabyte's Eagle DM-1 tape drive is a low-cost, high-capacity storage solution for stand-alone PCs as well as networked servers. Because it can record high-speed sources with variable data rates such as MPEG-2 video streams, you may eventually see it attaching to digital set-top boxes and Internet TVs as well. Another interesting application may be a PC video board converting TV signals into MPEG-1 and the Eagle DM-1 storing the data stream—in real time.

The system is brand new. Expect to see the first available systems early next year on the shelves of your local computer dealer.

Its miniature cartridges can store up to 26 GB at a data transfer rate of up to 4 MBps (for compressed data). This outstanding performance matches the requirements of video servers, and the price of around \$500 puts it within reach of consumers, who can use the tape drive for backing up hard drives and also for recording up to 7 hours of digital video. The device connects to a PC via SCSI-2, but it will eventually support USB and Fire-Wire interfaces.

The Eagle DM-1's magnetic head reads and writes eight parallel tracks simultaneously and has 24 vertical positions, so there are 192 tracks on the 8-mm tape. Positioning of the heads therefore has to be accurate to within a few micrometers.

The core of this multipurpose recording engine called DigaMax was developed by Philips. It uses a file system so that a standard PC can access it as just another drive. The file-system drivers for Windows 95 and NT allow a local hard drive to work as a cache for the tape, delivering excellent random-access times for on-line storage of, for example, Web pages containing video and audio streams or full-length digital feature films transmitted over satellite or cable.

—Bob Emmerson

### Monitors

#### 24-inch Monitor for the Mac and PCs

THE MIRO C2496 USES A 24-INCH-WIDE Trinitron tube and a 0.25-0.28-mm tension mask to display at a resolution of up to 1920 by 1200 pixels at 75 Hz. It lets you display two A4 pages plus tool palettes on one screen. The monitor meets TCO '92, MPR II, and Energy Star requirements. It ships with Mac and PC toolkits and adapters.

*Price: DM 6000.*  
*miro, Braunschweig, Germany, +49 531 2113 0; http://www.miro.de or http://www.miro-displays.com.*  
Enter 982 on Inquiry Card.

### Storage

#### Run Concurrent Backups

WITH TAPE COMMANDER, A TAPE CONTROLLER, you can integrate two single-drive subsystems into one dual-drive backup system. It works with 4-mm, 8-mm, and DLT drives or auto-loaders, and can read and



write two formats on both drives. The system allows you to create two backup copies at once, double the capacity of your storage system, copy data from one drive to the other without server intervention, or run two separate backup operations. Tape Commander's

buffer is upgradable to 64 MB.  
*Price: \$2000.*

*Transitional Technology International, Banbury, U.K., +44 1295 269000; http://www.ttech.com.*  
Enter 983 on Inquiry Card.

### CD-ROM Server Supports NDS

THE DATA PROVIDER CD-ROM SERVERS for Unix, OS/2, Windows, and NetWare 3.1 now support NDS. Integrated into an Ethernet or Token Ring network, the system provides simultaneous access to up to 70 CD-ROMs and also works as a Web server for corporate intranets. The units are available in tower or 19-inch-rack versions.

*Price: Starts at DM 5870.*  
*dtS Computer, Siegen, Germany, +49 271 3842 150; fax: +49 271 3842 161.*  
Enter 984 on Inquiry Card.

### Communication

#### ISDN Switches for Home Offices

THE ELMEG C23 AND C43 DIGITAL ISDN switches connect to up to three analog devices. In addition, the higher-priced C43 features an internal So-Bus. Both devices come with improved terminal software that includes more flexible MSN (Multiple Subscriber Numbers) management and automatic line switching.

*Price: C23, DM 349; C43, DM 599. Elmeg GmbH Kommunikationstechnik, Peine, Germany, +49 5171 909 345; http://www.elmeg.de.*  
Enter 985 on Inquiry Card.

# DAQ Made Simple

with DAQ Wizards in  
LabVIEW™ 4.1



Today, thousands of users are successfully using LabVIEW, the world's leading instrumentation software package, in their data acquisition (DAQ) systems.

Now, with the **new DAQ**

**Wizards in LabVIEW 4.1**, successful DAQ applications are easier than ever. From the time you open the LabVIEW package, you are only a few minutes and a few mouse clicks away from a custom solution designed for you. Whether you are looking for a temperature monitoring system, a PC-based multimeter, oscilloscope, or waveform generator, or

countless other applications, LabVIEW 4.1 has you up and running in a fraction of

the time it takes with other software. Discover how the new DAQ Wizards bring you instant success!



## Free LabVIEW 4.1

## Evaluation Package

[www.natinst.com/mags/labview41.htm](http://www.natinst.com/mags/labview41.htm)

**NATIONAL INSTRUMENTS™**  
The Software is the Instrument™

### European Branch Offices:

Austria 0662 45 76 26 00  
Belgium 02 757 00 20 • Denmark 45 76 24 24  
Finland 09 527 2321 • France 01 48 14 24 24  
Germany 089 741 31 30 • Italy 02 41 30 91  
Netherlands 31 348 43 346 6 • Norway 32 84 84 00  
Spain 91 640 0085 • Sweden 08 730 49 70  
Switzerland 056 200 51 51 • U.K. 01835 523545

### U.S. Corporate Headquarters

Tel: (512) 794-0100 • Fax: (512) 794-8411

[info@natinst.com](http://www.natinst.com) • [www.natinst.com](http://www.natinst.com)

Worldwide network of direct offices and distributors.

© Copyright 1997 National Instruments Corporation. All rights reserved.

Product and company names listed are trademarks or trade names of their respective companies.

## SOFTWARE Communications

### Fax Server Supports Unix and NT

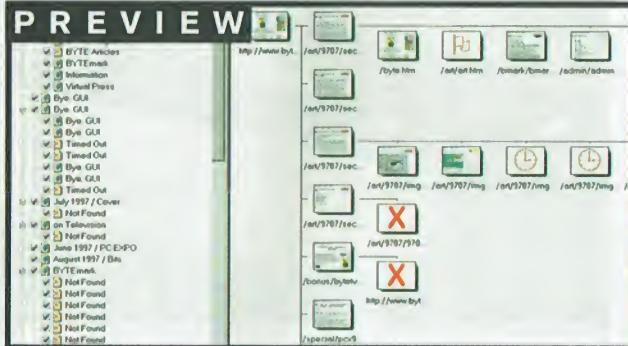
SUPPORTING SEVERAL WINDOWS NT AND Unix servers in one network, ComFAX is a fax server with extensive gateway functions. It connects to

SAP's R/3 and R/2, and allows you to send and receive faxes or e-mail via MAPI-compliant applications. ComFAX also provides fax-on-demand as well as Internet and intranet connectivity.

**Price:** DM 1730.

**Com-EM-Tex, Munich, Germany, +49 89 54 75 00;**  
<http://www.com-em-tex.de>. Enter 999 on Inquiry Card.

## PREVIEW



### PowerMapper 1.0

£76

**Enter 1015 on Inquiry Card.**

### Electrum Multimedia

Edinburgh, U.K.

+44 131 555 4241

<http://www.electrum.co.uk>.

## Find It on the Site Map

Site maps are useful navigation assistants that mirror the architecture of a Web site graphically and let users find their way through a site's document hierarchy. Unfortunately, site maps are not as widely used as you might expect. One reason may be that it is still hard for Webmasters to find good mapping tools, although some Web development suites include mapping features.

Electrum Multimedia's PowerMapper 1.0 focuses on just creating site maps. And it does it very well.

PowerMapper includes a Web-crawler engine that analyzes site structure by collecting links from each page it visits. It then maps the deduced structure into a GIF image containing an HTML document that you can view with any browser. With this approach, you don't need an additional plug-in to view the map, as in some other tools, and you can jump to a document in the map with a mouse-click.

The tool provides for four mapping styles: a hierarchical tree with 3-D buttons, a map that represents each page as a thumbnail and also helps you check for consistent graphic placement on pages, an isometric view that maximizes the number of pages displayed on a map, and a text-only table-of-contents version. You can remove individual pages and even entire branches of the site, if you think it aids visitors' understanding of the site structure, and rename each page without editing the original HTML. In addition, PowerMapper detects broken links, HTML errors, server errors, and errors in page titles. It also pays attention to robot-exclusion standards.

PowerMapper is a well-designed tool that helps Webmasters build easier ways to navigate sites. The only shortcomings: the lack of proxy-server functionality that would let you design maps off-line and the fact that it maps a Web site's structure in only three hierarchical levels, a serious restriction in mapping big sites.

—Rainer Mauth





# **Smau '97. Harvest the future.**

Fresh, inviting and full of promises: the future at Smau is for you to harvest. A future where computers, telecommunications and media are integrated to help us live and work better. Smau is the largest Information and Communications Technology (ICT) exhibition in Italy, and the fall's pre-eminent trade show in Europe in this sector. The place where you can sample the bounty of new and exciting technologies.

On Thursday 2, Saturday 4 and Sunday 5 October, Smau is open to everyone. For three days, Smau '97 is your chance to gather all of digital technology's latest offerings and solutions. New products, exhibits and conferences for you to get a taste of the future.

On Friday 3 and Monday 6 October, Smau is open to the trade. For two days, Smau '97 will be reserved exclusively for those in the ICT trade in search of new, fresh business opportunities. Fourteen specialized areas - as well as seminars and workshops - to make professionals and business meet.

At Simu '97, the future is ripe. Just reap it.

**Smau. Where the future is present.**

**Milan Fair, October 2-6, 1997, 10 am - 7 pm.**

<b>Thursday</b> <b>2</b>	<b>Saturday</b> <b>4</b>	<b>Sunday</b> <b>5</b>	<b>Open days</b> (free entrance for foreign visitors on all five exhibition days)
<b>Friday</b> <b>3</b>		<b>Monday</b> <b>6</b>	<b>Trade days</b>

Smau: tel +39 (2) 28313.454 - fax +39 (2) 28313.213 - [www.smau.it/magellano](http://www.smau.it/magellano)



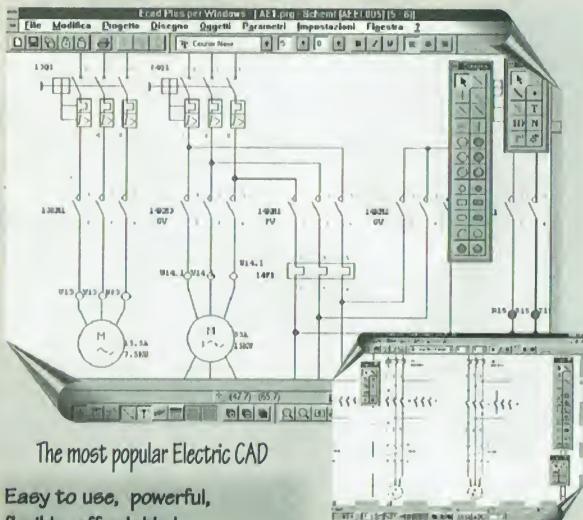
 **smau**

International exhibition of information & communications technology



# ECAD Plus Win

Electrical Electromechanical CAD Solutions



The most popular Electric CAD

Easy to use, powerful,  
flexible, affordable!

Fully Automatic functions:  
Wire Numbering, Cross Tables  
Custom Part List, Cabling List ...

Free  
Demo

Special Price \$1950

Microdata System srl - <http://www.microdata.it>  
Tel +39-187-988.460 ITALY Fax +39-187-988.322

Circle 443 on Inquiry Card.

## Set up your own business! Join the GTC®-world!

GTC® is one of the leading faxproviders in Germany and allows international faxing for everybody at lowest rates. GTC® is looking for people around the world who can proceed faxes in their own country at local rates. GTC® provides you with the capability of worldwide faxing at lowest rates. Your investment to become an international faxprovider in your country is less than 2.000 \$ US. Please contact us immediately for free information:

GTC® TeleCommunication GmbH faxeins@fax7.gtc.net  
phone: +49-711-23877-0 fax: +49-711-2387715

Circle 463 on Inquiry Card (RESELLERS: 464).

## Databases

### Scan Legacy Databases on the Web

INTERNET DATASpot BRINGS COMBINED search facilities to SQL, ISAM, ODBC, and flat-file databases, thus letting



session CDs and implement comprehensive audio indexes. It also supports mixed-mode recording and error correction, which increases audio quality. The software includes a multisession mounter for Windows 95/NT and interoperates with CD-R and CD-Rewritable devices.

Price: DM 99.

Ahead Software,  
Karlsbad, Germany,  
+49 724 891 1800;  
<http://www.ahead.de>.

Enter 1007 on Inquiry Card.

## Office

### Office-X Extends Microsoft Office

OFFICE-X FOR WINDOWS 95/NT IMPROVES cooperation between Microsoft Office applications. It adds identical AutoFind, AutoForm, AutoLink, and AutoStore to each application of the Office suite, thus improving connection, searching, and organization of documents. It automatically displays all document-related information in trees.

Price: \$8995.

Data Technologies, Tel Aviv,  
Israel, +972 364 71661;  
<http://www.dataspot.com>.

Enter 995 on Inquiry Card.

### Call-Center Software Runs Java

CALLMANAGER 3.0, WHICH IS CALL-CENTER software, tracks incoming calls, e-mail, and faxes to record actions relating to a call and to organize help desks. With CallManager 3.0, every desktop can have access to all calls and connect them to any extension. The system, which was developed completely in Java, stores data in an Oracle database and automatically backs up databases every 15 minutes.

Price: Starts at DM 3900.

ConSol Consulting & Solutions,  
Munich, Germany,  
+49 89 458 411 00;  
<http://www.consol.de>.

Enter 998 on Inquiry Card.

## Utilities

### SpringBoard Launches Windows Applications

MICROTOPE'S SPRINGBOARD'97 PROGRAM launcher lets you start any of 20 predefined programs from within a running application on your PC. The corresponding program appears in a menu that SpringBoard'97 adds to the application. The package includes 16- and 32-bit versions of SpringBoard'97 for all Windows desktop flavors.

Price: £20. Microtrop, Banbury, U.K., +44 1295 252002;

<http://www.microtrop.com>.  
Enter 1008 on Inquiry Card.

## CD-Recording

### Nero Improves CD Recording

WITH NERO 2.0 CD-RECORDING SOFTWARE, you can link tracks of multi-



# One makes software theft illegal, the other makes it impossible.

If you would rather take the law into your own hands, the DESkey range of products have security designed into the hardware. ASICs and microprocessors running proprietary algorithms provide real protection for your software application. A comprehensive range of drivers and our software protection utility, DESlock, work to bring the highest level of security with the minimum of effort.

Call today for product information, demonstration units and technical advice.

*Don't just Dongle it – DESkey it*

PC MAC PC Card UNIX etc



**D DESkey**

**Data Encryption Systems Limited** Silver Street House, Silver Street, Taunton, Somerset TA1 3DL

Tel +44 (0) 1823 352357 Fax +44 (0) 1823 352358 BBS +44 (0) 1823 352259 E-mail sales@des.co.uk [www.des.co.uk](http://www.des.co.uk)

**ELPROMA ELECTRONICA** Nijendal 42, 3972 KC Driebergen, Postbus 170, 3970 AD Driebergen, The Netherlands  
Tel +31 (0) 343 518724 Fax +31 (0) 343 512286 E-mail [info@elproma.nl](mailto:info@elproma.nl)

# INTERCON - PRINT SERVER

## For Excellent Connections



### Features

- Configurable with any HTML 3.x Internet browser
- Multiprotocol support of all operating systems
- Automatic recognition of the used network connector
- Software update/upgrade via download in Flash-EPROM
- Printer status request from host computer
- Automatic protocol recognition
- Configuration parameters can be edited by software
- Configuration via printer operation panel (for KYOCERA)
- Recognition and reaction to network environment changes
- Supports 16 queues on 16 servers (Novell)
- Support of 8 logical printers
- Easy Installation via PCONSOLE (Novell)
- Status button



### More information about InterCon:

SEH Computertechnik GmbH  
Südring 11 D-33647 Bielefeld, Germany  
Phone: +49 / 521 / 94226-0  
Fax: +49 / 521 / 94226-99  
Internet: <http://www.seh.de>  
E-Mail: [info@seh.de](mailto:info@seh.de)  
Compuserve-Id: 100742,1452

### Software Support

- Novell 4.x NetWare Directory Services (NDS)
- Novell 2.x, 3.x, 4.x Bindery Mode
- SNMP (MIB II and SEH Privat MIB)
- HTML/HTTP configurable
- UNIX (TCP/IP)
- Apple Ether/TokenTalk
- Windows NT (TCP/IP)
- Windows '95 (SEH PrintMonitor)
- BS2000 RSO Spool (V. 2.3A, V. 3.0A)



### Hardware Support

Ethernet 10Base2/5/T/FL (BNC, AUI, RJ45, ST)

- IC53-ETHER-KYO-5
- IC53-ETHER-KYO-FL
- IC55-ETHERPOCKET
- IC57-ETHER-EPSON

Token Ring STP, UTP (IBM Type1/2, Type3)

- IC60-TOKEN-KYO

Ethernet 100BaseTX (RJ45)

- IC73-FAST-KYO-TX
- IC77-FAST-EPSON-TX

**SEH**  
Computertechnik GmbH

*CyberMax's ValueMax C5 promises Pentium II power at Pentium prices. By Tom Yager*

## First 6x86 PC: Generally a Winner

In most organizations, the push to provide users with powerful computers is running smack-dab into the need to save money. Fortunately, \$2000 can now buy a mature system with a previous-generation Pentium chip or—even better—a leading-edge powerhouse with a processor from Cyrix or AMD.

CyberMax, often first or second in line with systems sporting new non-Intel CPUs, sent me the \$1999 ValueMax C5 PR 233, a Cyrix 6x86MX-based machine.

The unit came with 32 MB of RAM and a 4-MB Matrox Millennium II graphics adapter. (CyberMax's Web site lists a 4-MB Matrox Mystique card as standard.) The test unit also had a 6-GB Enhanced IDE (EIDE) hard drive, a 24x CD-ROM drive, an Ensoniq AudioPCI wave-table sound card, and a Computer Peripherals 56-Kbps flex modem with speakerphone features. The system also included two universal serial bus (USB) ports with the connectors installed.

I was impressed with the choices CyberMax made for the internal hardware, but not with the external components. For example, the ValueMax C5's case, keyboard, and mouse are flimsy.

I loaded such familiar applications as Microsoft Office 97 and Microsoft's Visual Studio development tools. They installed and ran fine, and I was pleased



**ValueMax C5 PR 233**  
**\$1999**

CyberMax Computer, Inc.  
Allentown, PA

800-345-8939  
(610) 770-1808  
fax: 800-599-7576

<http://www.cybmax.com>

Enter 978  
on Inquiry Card.

**The ValueMax's beefy configurations include a 24x CD-ROM drive, a 56-Kbps flex modem, and a 4-MB Matrox VGA card.**

with the performance. To test OS compatibility, I loaded Windows NT Server 4.0 and Caldera OpenLinux. Both installed effortlessly, thanks partly to BIOS support for bootable CD-ROMs.

The Hellbender game ran smoothly at 640 by 480 pixels, taking advantage of the Millennium II's hardware-accelerated 3-D graphics. Doom II was mute under DOS, but it successfully ran (with wave-table orchestration) in a Windows 95 DOS box. However, Kinetix 3D Studio Max under Windows NT 4.0 crashed when I tried to load certain scene files.

I ran BYTEMarks on this system and compared the scores to those of a 180-MHz Pentium Pro machine. Integer tests on the ValueMax C5 were comparable, yet floating-point scores were well below the Pentium Pro's (see the benchmark table). Running my 3D Studio Max test, it took 36 seconds on the ValueMax C5 to render a scene with ray-traced shadows. That's

nearly double the 19 seconds for the Pentium Pro machine to draw the same scene.

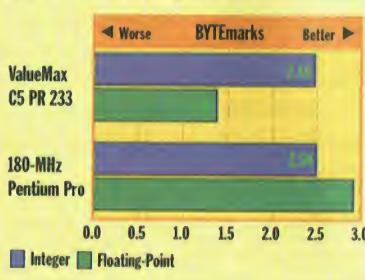
For \$2000, you can't buy a Pentium Pro or Pentium II system configured as well as

RATINGS				
TECHNOLOGY	★	★	★	★
IMPLEMENTATION	★	★	★	★
PERFORMANCE	★	★	★	★

the ValueMax C5. If you're running CAD, heavy graphics, or financial or statistical applications, this system might not be right for you. But for general-purpose applications, software development, home offices, or even light server duty, floating-point doesn't matter. The ValueMax C5 is an impressive buy, a real power machine at the price of a basic desktop unit. **B**

*Tom Yager is a freelance analyst and writer located in north Texas. You can reach him at [tyager@maxx.net](mailto:tyager@maxx.net).*

### CyberMax BYTEMarks



Java comes of age with a full-featured development environment from Borland. By Peter Wayner

## JBuilder Makes Java a Piece of Cake

**W**hen Java burst onto the scene in 1995, Sun offered it to the world with Stone Age Unix tools. It was only a matter of time before top-grade Java tools made it to market: Microsoft responded with J++, which integrated Java with ActiveX. This summer Borland introduced JBuilder, a highly integrated Java environment that produces pure Java and JavaBeans.

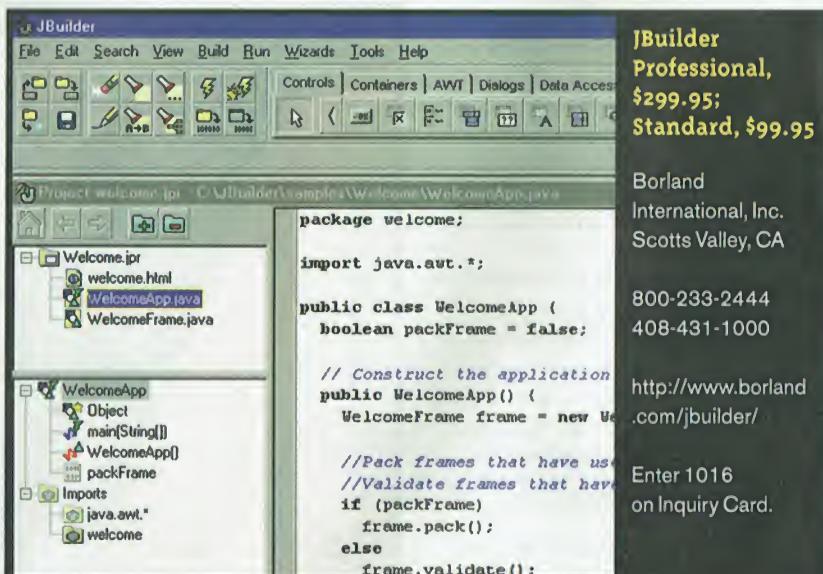
The news is good for programmers. Java's structure makes it much cleaner than C++ and gives developers plenty of room to exploit that structure and automate much of their production.

The automation is obvious from the beginning. When you open a new file, you don't just get a text window waiting for code: JBuilder presents a dialog box so that you can create a new Applet, Application, JavaBean, Class, Component, or a host of other items. JBuilder produces a skeleton for the code when you fill in dialog boxes with object parameters. It's possible to thread together the bulk of an application using built-in tools, coding only the program logic itself.

### TECH FOCUS

#### Code Obfuscation

JBuilder's intriguing "code obfuscation" feature makes it harder for others to download your Java code, modify it subtly, and release it as their own. The process involves two parts, the first of which is not necessarily new. The compiler often rearranges code to speed up execution, and these manipulations often obscure the details in the information-rich Java byte code. The second step involves giving private and local variables strange, uncompliable new names that make it harder to trace through the code by hand. Decompiled code is also guaranteed to be uncompliable because it comes with illegal characters in the names.



**JBuilder Professional, \$299.95; Standard, \$99.95**

Borland International, Inc.  
Scotts Valley, CA

800-233-2444  
408-431-1000

<http://www.borland.com/jbuilder/>

Enter 1016  
on Inquiry Card.

**The JBuilder interface combines a component toolbar, hierarchical trees for project files and class methods, and a code-editor window.**

JBuilder builds properly structured JavaBeans, persistent objects that you can customize and that are easy to manipulate and build into GUIs. A wizard constructs the basic shell structure of a JavaBean for you. The parameters and details are bound up with the code and are dynamic, unlike in traditional development environments, where code is static and doesn't change once it's compiled.

The most attractive part of JBuilder may be its database integration: It comes with some standard Java Database Connectivity (JDBC) components to integrate with databases, although to use JBuilder for heavy database work you need JBuilder Professional, which comes with a set of tools, called DataExpress, that simplifies SQL database access. Most professionals will want the Professional version, which adds extra wizards, live graphing components, and a range of database tools.

Orland knows what programmers

want, and JBuilder offers most of that, although a Client/Server version with tools for developing enterprise-wide products

### RATINGS

TECHNOLOGY	★	★	★	★	★
------------	---	---	---	---	---

IMPLEMENTATION	★	★	★	★	★
----------------	---	---	---	---	---

is still in the works. JBuilder's broad range may represent a turning point for Java. A year ago, people struggled to make items dance across a Web page; today, coding stand-alone applications is as convenient in Java as it is in C++. Many programmers are already switching from C++ to Java for the built-in memory management and Java's write-once, run-anywhere philosophy. JBuilder makes the switch all the more attractive. **B**

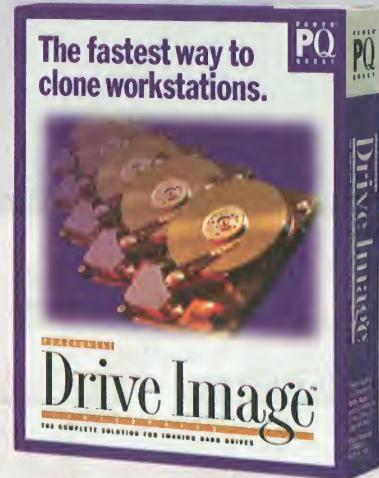
*Peter Wayner is a BYTE consulting editor based in Baltimore. His home page is at <http://www.access.digex.net/~pcw/pcwpage.html>.*

NOW,

# cloning YOUR workstations IS THIS easy.

INTRODUCING **Drive Image™ Enterprise**. THE **fastest**, MOST **flexible** WAY TO **clone** YOUR **workstations**.

Cloning workstations should be as easy as cutting out paper dolls—make one master image file, and clone it as many times as you want. Well, PowerQuest® has made the process of cloning workstations just that simple and fast with Drive Image Enterprise. Because of its patent-pending SmartSector™ technology, Drive Image Enterprise works up to two to three times faster than straight file-by-file or sector-by-sector methods of copying. And using its exclusive image-file editor, as well as the award-winning technology of PartitionMagic®, you can swap partitions between image files, even create, resize and move FAT, FAT32, NTFS, and HPFS partitions on the fly. This gives you the unprecedented freedom to create customized configurations to meet all the needs of your individual workstations. This speed and flexibility make Drive Image Enterprise the complete solution for cloning workstations. For more information, or to learn about PowerQuest's affordable multiple workstation or site-licensing options, contact your local reseller, or visit our Web site at [www.powerquest.com](http://www.powerquest.com) or call **1-800-379-2566**.



The fastest way to  
clone workstations.



**Drive Image**  
THE COMPLETE SOLUTION FOR IMAGING HARD DRIVES

Try Drive Image Enterprise for **60 days**. If you're not completely satisfied, return it to PowerQuest and receive a full refund.

© 1997 PowerQuest Corporation. All rights reserved. PowerQuest and PartitionMagic are registered trademarks and Drive Image and SmartSector are trademarks of PowerQuest Corporation. Patents pending.

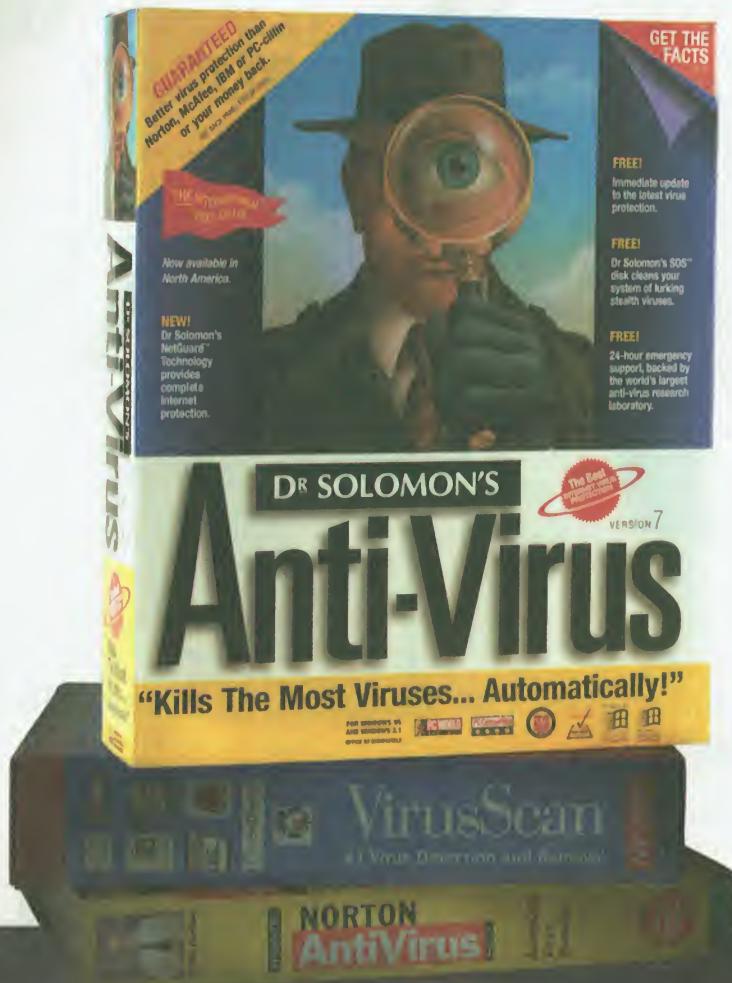
FROM THE MAKERS OF PARTITION MAGIC®

POWER®  
**PQ**  
QUEST

Circle 123 on Inquiry Card (RESELLERS: 124).

# “Dr Solomon’s Anti-Virus... once again placed at the top.”

— *PC Magazine*



The experts agree, Dr Solomon's is the best anti-virus software available today. In study after study, test after test, Dr Solomon's scored higher detection rates than any other product.

Now, for a limited time only,\* if you own any other anti-virus software you will get \$30 back when you purchase Dr Solomon's Anti-Virus software. Look for coupons and specially marked boxes at retail stores everywhere.

\*Offer expires Dec 31, 1997

# SAVE \$30.00

COMPETITIVE REBATE

D<sup>R</sup> SOLOMON'S



1-800-960-9095 EXT. 189

[www.drsolomon.com](http://www.drsolomon.com)

617-273-7400

#### MACRO VIRUS DETECTION RATE



#### BOOT-SECTOR VIRUSES



SOURCE — *Secure Computing, January 1997*

SOURCE — *University of Hamburg, February 1997*

Circle 131 on Inquiry Card.

#### DETECTION OF VIRUSES IN COMPRESSED AND ARCHIVED FILES



SOURCE — *Secure Computing, January 1997*

*The next-generation ThinkPads offer DVD and 20X CD-ROM options, full MPEG-2, and more. By David Essex*

## The Best ThinkPad Gets Better

**B**YTE has raved about IBM's high-end ThinkPad notebooks before. The 760CD was voted Best Notebook in our Fall 1995 Comdex awards, and we named it an Editors' Choice that same year. Now IBM is upgrading this elite line with clear improvements in nearly every feature.

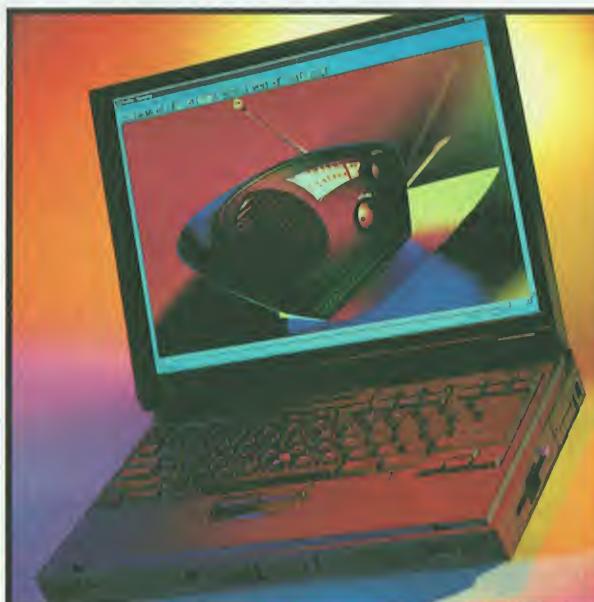
The ThinkPad 770, which was due out in September, strikes you first with its too-roomy-to-be-believed 14.1-inch color thin-film transistor (TFT) screen. IBM claims a 34 percent brightness increase, and while I didn't test this with a light meter, my prebeta unit had the brightest, clearest screen I've seen on a notebook.

Powering the LCD is a 64-bit Trident chip set, providing SVGA at 1280 by 1024 pixels. Clear viewing is maintained at about 45 degrees off-center in all directions. Try as I might, I couldn't find a single blurry spot or dead pixel, and even the brightness is more or less consistent.

For raw power, the 770 beats its predecessors by a mile, offering either a 233- or 200-MHz MMX Pentium CPU. (A less-expensive 13.3-inch screen is available on both models, which range from \$5500 to \$7000.) You can squeeze in up to 256 MB of high-speed synchronous DRAM (the system comes with 32 MB). The high-end model has a 5.1-GB hard drive.

Besides improving existing features, IBM made some major design changes. The keyboard is now integrated into the main unit rather than on an angled, pop-up plane. IBM says that it adopted the keyboard from the ThinkPad 560 line, and it expanded the palm rest for greater comfort.

The ThinkPad's eraser-like Trackpoint mouse controller has also changed. You can now double-tap on it directly to select a screen item without having to press the buttons on the palm rest. Joining the latter is a new center button that you can use for fast scrolling and panning around



**ThinkPad 770**  
Approximately  
\$7000

(estimated at press time)

IBM Personal  
Computer Co.  
Somers, NY

800-426-2968  
fax: 800-426-3395

<http://www.us.pc.ibm.com/thinkpad>

**The 770's 14.1-inch screen shows off graphical images in all their hi-res glory, including MPEG-2-driven full-motion video.**

documents, as well as for zooming in.

Eliminating the pop-up keyboard removed the entry point for the older ThinkPad's UltraBay storage slot. The new slot,

### RATINGS

TECHNOLOGY	★	★	★	★	★
IMPLEMENTATION	★	★	★	★	

called the UltraBay II, now sits in the front of the notebook's right side. You get to it by moving a small front-mounted slider, which releases a large lever that pushes out the storage device. The digital videodisc (DVD) drive will go here when it's ready later this year. This bay also accepts a removable floppy drive, a CD-ROM or Zip drive, a second hard drive, or a battery. An optional screw underneath lets you lock the storage device in place for added security.

As a piece of multimedia road equip-

ment, the 770 needs to keep up on standards. Boy, does it ever. Hardware-based MPEG-2 offers full-screen, full-motion video—a big improvement in pixelation over the already-decent quality of the 760's half-horizontal-resolution MPEG-1. In addition to the typical microphone, headphone, and audio/video in/out ports found on older models, the 770 now has ports for universal serial bus (USB) peripherals and Sony/Philips Digital Interface (SPDIF) audio devices.

My test unit wasn't ready for benchmarking, and I couldn't use the PC Card slots or DVD, so performance and reliability are unknowns. But by upgrading its multimedia ThinkPad line on nearly every front, IBM has made a great notebook even better. **B**

*David Essex is BYTE's director of reviews. You can reach him at [dessex@bix.com](mailto:dessex@bix.com).*

Open-standards-based multipoint videoconferencing over IP is a reality with White Pine's MeetingPoint. By Steve Gillmor

## A New MeetingPoint for Videoconferencing

White Pine's MeetingPoint Conference Server marks a major advance in the convergence of computers, video, and telephones. This companion product to the pioneering CU-SeeMe videoconferencing client extends a welcoming hand to all H.323 standards-based clients and allows multipoint conferencing over the Internet. MeetingPoint arrives just in time to leverage an always-on and always-connected world that's becoming even more so with Microsoft's H.323-compliant client NetMeeting (bundled with Internet Explorer) and Netscape's promised H.323 client for Communicator.

Building on White Pine's Reflector server, MeetingPoint merges multiple streams of video, audio, chat, whiteboard, and other data using open standards. MeetingPoint automatically detects bandwidth congestion and balances low-speed modem, ISDN/frame-relay wide-area, and high-speed LAN connections, so conferences are not dragged down by the lowest common denominator. You control the number of conferences, participants per conference, and data types per conference, setting upper

### TECH FOCUS

#### Following Conference Protocols

CU-SeeMe clients connect to MeetingPoint via a single port, first using TCP to determine information about active conferences and then switching to a single UDP port to send all conference data: video, audio, and chat. Each UDP packet contains information in the header that describes which user sent the packet. By contrast, H.323 clients such as NetMeeting receive five UDP ports during the initial TCP connection sequence, using correspondingly more server resources to maintain the connection.

Name	IP Address	Connect Time	Host Machine
syzygy	192.80.72.171	00:00:46	192.80.72.125
seswho	192.80.72.125	00:04:19	192.80.72.125
Annen	192.80.72.152	00:04:49	192.80.72.125
CookeQ_B (HAC)	192.80.72.108	00:05:49	192.80.72.125
JesseSb	192.80.72.225	00:06:25	192.80.72.125
Cruiser	140.249.200.96	00:07:05	192.80.72.125
Net Meeting	192.80.72.27	00:07:10	192.80.72.125
Wynneham (I-APP)	192.80.72.129	00:07:21	192.80.72.125

You can monitor and administer live conferences using MeetingPoint's Web-browser interface.

limits on data rates for transmissions.

MeetingPoint installs three default conferences covering a range of bandwidth situations from direct LAN users to dial-up modem users. The Monitoring screen lets administrators or conference chairs grant or revoke user access and the ability to send data streams.

Installing MeetingPoint on a Windows NT 4.0 server with 64 MB of RAM and a 200-MHz multimedia extensions (MMX) processor, I configured the server with a browser GUI enhanced with Java applets. I tested the Winnov Videum capture board/camera combo and Connectix's QuickCam 2 parallel-port solution on local- and wide-area connections, hosting a MeetingPoint conference with a mix of CU-SeeMe and NetMeeting participants.

MeetingPoint scales well, supporting IP multicast in the corporate LAN; multicast support will also reduce bandwidth demands for Internet connections once

multicast is more widely supported. I successfully connected two MeetingPoint servers on separate LANs via 128-Kbps Internet ISDN links, maximizing local bandwidth and sending the combined

RATINGS				
TECHNOLOGY	★★★	★★★	★★★	★★★
IMPLEMENTATION	★★★	★★★	★★★	★★★

traffic over the smaller wide-area pipe.

Before I got my hands on MeetingPoint, IP videoconferencing seemed to me an interesting toy. After using it, I'm convinced it's a powerful tool. MeetingPoint enables truly open conferencing, linking different H.323 clients in group conferences on a single screen, something never before possible. **B**

You can contact Steve Gillmor, who is a consultant for Southern Digital, Inc., at [sgillmor@southerndigital.com](mailto:sgillmor@southerndigital.com).

# Power up with a 300MHz Pentium® II processor workstation and exceed the speed limit.



There is no limit to DTK's commitment to providing your business with the latest innovations in PC technology. Like our new APRI Series. These power-packed workstations feature a 300 MHz Pentium® II processor with Intel 440FX PCIset, or the 440LX PCIset. They deliver uncompromising speed and performance. Manage Windows® NT with ease and handle every power-demanding task on your agenda. From big-time number crunching financial applications to desktop publishing to Auto CAD jobs. To get your business up to speed, contact your reseller. Or call 1-800-BUY-A-DTK (1-800/289-2385).



## DTK Computer

[www.dtkcomputer.com](http://www.dtkcomputer.com)

### APRI-74M/K300 with 440FX PCIset

- 300/266/233 MHz Pentium® II processor
- 512KB L2 Cache
- Up to 512MB EDO RAM (ECC supported)
- Matrox Millennium II 3D graphic card with up to 16MB WRAM
- Seagate 6.4GB IDE or 9GB Wide SCSI Hard Drive

### APRI-76M/K300 with 440LX PCIset

- 300/266/233 MHz Pentium® II processor
- 512KB L2 Cache
- Up to 512MB SDRAM
- Matrox Millennium II AGP graphic card to support high performance 3D graphics
- Ultra DMA supported

See us at Booth #3633 COMDEX Fall '97

Boston  
617/932-3800  
Indianapolis  
317/546-8805

New York  
908/562-8800  
Milwaukee  
414/679-7870

Washington, D.C.  
703/222-9194  
Minneapolis  
612/557-1973

Atlanta  
770/279-1385  
Kansas City  
913/492-3800

Miami  
305/597-8888  
Dallas  
972/484-8535

Pittsburgh  
412/373-6750  
Houston  
281/568-6688

Cleveland  
216/349-1995  
Scottsdale  
602/451-6774

Chicago  
847/593-3080  
Los Angeles  
626/810-0098

The Intel Inside Logo and Pentium are registered trademarks and MMX is a trademark of Intel Corp. Windows NT is a trademark of Microsoft Corp. © 1997 DTK Computer, Inc.







Under  
\$300

### omni.net

Go on-line for less with this simple, fast, cost-effective, 128Kbps **ISDN Terminal Adapter**.

Features Multilink PPP, Bandwidth-on-Demand, Call Bumping, Stac<sup>®</sup> Compression, up to 460Kbps DTE throughput, two Analog Ports, BRI S/T or U Interface and Flash EPROM Firmware.



Two-User  
Support

### Omni TA128

This revolutionary **ISDN Terminal Adapter** allows two users to share one ISDN line. Features Multilink PPP, Stac<sup>®</sup> Compression, Bandwidth-on-Demand, Call Bumping, two Analog Ports, two Serial Ports, up to 460Kbps DTE throughput, BRI S/T or U Interface and Flash EPROM Firmware.



56K  
Upgradeable

### Elite 2864I

The industry's first **ISDN Modem** to achieve backward compatibility with V.34 analog modems.

Features built-in V.34 Modem, Multilink PPP, V.120, V.110 & X.75, Stac<sup>®</sup> Compression, Standalone Fax, Voice Digitization, Microphone and Speaker Jacks, Serial & Parallel DTE Interfaces, one Analog Port, up to 460Kbps DTE throughput, Password Protection, Embedded Protocol Analyzer and Flash EPROM Firmware.

# Everything You Need For ISDN Access Is Here



### Prestige 2864I

The first **ISDN Remote Access Router** to provide interoperability with V.34 analog modems. Features Multiple Single User IP

Account (SUA<sup>™</sup>), IP/IPX Routing, Transparent Bridging, Dial-on-Demand, BOD, PPP/MP, V.120, X.75, Stac<sup>®</sup> Compression, one Analog Port, Menu-based Configuration via Telnet, DHCP, Integrated SNMP, PAP/CHAP, and Firewall.



Two  
Analog  
Ports

### Prestige 128

This new Dial-on-Demand **ISDN Bridge/Router** provides a complete low-cost solution for wide area networking and corporate Internet access. Features Multiple Single User IP Account (SUA<sup>™</sup>), IP/IPX Routing, PPP/MP, V.120, X.75, Stac<sup>®</sup> Compression, BOD, Remote Configuration via Telnet, DHCP, SNMP, PAP/CHAP, Firewall and two Analog Ports.

# ZyXEL

ACCESSING INTERNET & INTRANET

#### WORLDWIDE SALES

Phone: 886-35-783942  
Fax: 886-35-782439  
sales@zyxel.hinet.net

#### NORTH AMERICA

Phone: 714-693-0800  
Fax: 714-693-8811  
sales@zyxel.com

**1-800-255-4101**  
**www.zyxel.com**

INGRAM  
MICRO

yes  
I run with  
NetWare

dnv  
IOC S  
and  
EZ-ISDN  
Capabili

Circle 117 on Inquiry Card (RESELLERS: 1)

# ISDN - FAST, AFFORDABLE, EASY. - NOW!

Whether you need a modem, a terminal adapter, a router or all of the above, ZyXEL is your one-stop source for ISDN. From home Internet access to corporate networking and everything in-between, we've got the product to meet your application. All ZyXEL products are packed with features, functions and services designed with one objective in mind: to make ISDN easy for you. In fact, ZyXEL ISDN is so easy, so affordable and so usable, you'll wonder what you ever did without it! IOC codes and EZ-ISDN compliance make ordering your ISDN line fast and hassle free. Plug-and-play installation, and simple menu-based configuration will get you up and running with ISDN in mere minutes.

Why wait? ZyXEL ISDN is waiting for you! Call now. (800) 255-4101

*The Web's content can be harvested for information that's crucial to making strategic decisions. By Richard Hackathorn*

## Farming the Web

**T**he Web and data warehousing (DW) are a powerful combination. Publishing warehouse data via the intranet has become a highly productive approach. By generating dynamic pages from Web-enabled databases, whole new areas of data analysis are supported. No one, however, has seriously considered putting content from the global Internet into the data warehouse. Web content is considered too unreliable, and data external to the organization is often considered to have little business value.

But I would argue to the contrary. As markets become turbulent, the old way of doing business with data only from internal operational systems becomes less relevant. A company must know more about its customers, suppliers, competitors, and government agencies than ever before. Much of this external data is readily available on the Web. The challenge is to wade (with big boots) through the Web, discovering and acquiring those pieces that do have an impact on the business.

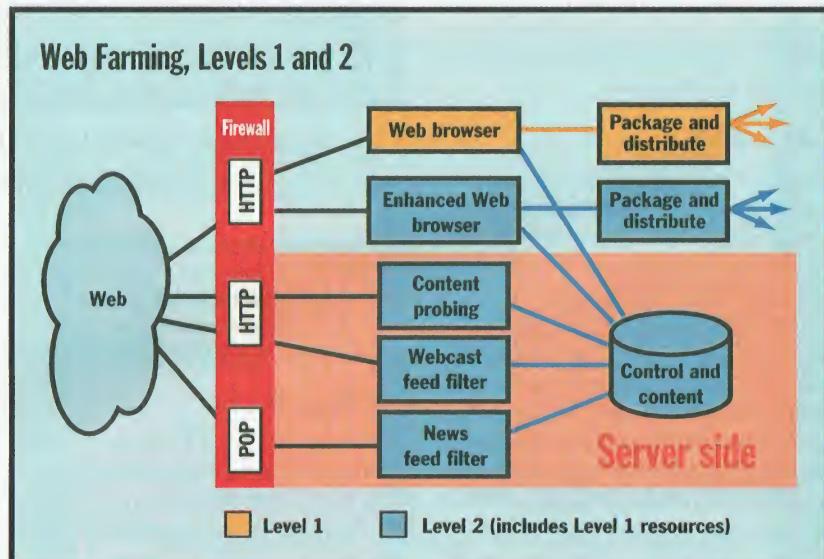
The emerging area that is concerned with this challenge is called Web farming (WF). WF is the systematic discovery and acquisition of business-relevant Web content as input to the data warehouse. It has three goals. First, to discover and acquire Web content that is highly relevant to the business. Second, to structure that data so that it becomes an integral part of the existing data warehouse. Third, to accomplish this in a systematic manner that evolves into a production system. WF must deliver information of value to the business, to the right people at the right time. This is the same objective as the data warehouse. Hence, WF and DW should be closely integrated.

### Getting Started

The first level of WF documents the external factors that affect the business, and

predicts the potential factors that will affect it in the future. Possible avenues of investigation are: analysis of recent company reports and press releases; critiques of your company by news and

important to the business. The principal cost item should be a highly skilled business analyst who has a solid understanding of the business. This level should be implemented quickly and cheaply, with



**These levels determine the feasibility of Web farming and build its infrastructure.**

investment analysts; and observations of typical customers performing transactions. Then, compile a detailed, hierarchically organized list of these external factors. Prioritize the list based on the potential impact (either positive or negative) of each factor upon the business.

Formulate a systematic plan for searching the Web for relevant information, starting with the highest-priority factors. When a useful item is found, format and package it as memo, report, spreadsheet, chart, presentation, or e-mail. Immediately disseminate it to the people who should have a keen interest in it. Then, track the reactions to this information.

In the first level, you're building the foundation for determining what is

feedback expected in one or two months. The end result should be documentation of the business factors associated with an organized list of URL bookmarks.

### Getting Serious

The second level of WF requires a serious management commitment of resources to pursue WF as a means of expanding coverage for the data warehouse. Its objective is to establish the WF infrastructure within a secure server environment. Under the umbrella of the DW group, the data within the existing data warehouse should be supplemented by expanding its coverage of those external factors impacting the business. The second level involves the transition from

a self-contained workstation to a secure server environment, as shown in the figure "Web Farming, Levels 1 and 2." On the client side, the number of analysts should increase as demand of packaged information from Web content increases.

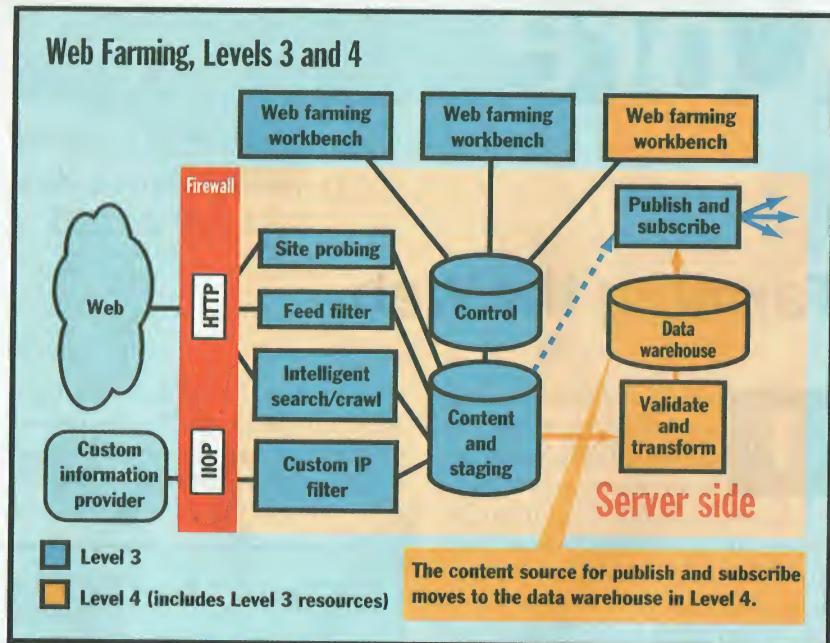
The important changes occur on the server side of the architecture. A database shared among the analysts manages the Web content and various control information such as favorite bookmarks, useful searches, and the like. Data center staff should administer the WF server. Besides the sharing of common data among the analysts, the server takes on the active role of periodically probing those Web pages identified as important. As useful information becomes available on Webcasting channels, e-mail feeds, and newsgroups, you should implement filters to capture, filter, and format that data into the WF server.

## Get Smart

The third level of WF builds upon the previous infrastructure to increase the relevance of Web content to your business. Its objective is to get smart about discovering and acquiring new information, and about distributing it. This focus occurs in two places. First, the information acquisition is expanded with intelligent Web searching and with custom information providers. Second, the information distribution is expanded enterprise-wide through the implementation of the publish and subscribe (P&S) mechanism (as shown in the figure at right).

At this level, the objective is to transform the content database into a full-function intranet Web site that serves as a custom resource center for the entire company. The goal is to shift over time from static content of digested Web pages to dynamic content generated from warehouse tables.

Another change is the adoption of a WF workbench environment for analysts. Controlled via a common database, the workbench integrates the browser with other tools, such as linguistic analysis and information visualization. The workbench should increase the productivity of the analysts to discover relevant information. Using P&S, specific channels of information related to important business topics are published. Various people (and applications) can then subscribe to these channels to receive a flow of information on a continuing basis. Finally, you



These levels build the operation into an intranet Web site and integrate it with the data warehouse.

should contract custom information providers to supply reliable data via efficient links using, for example, the Internet Interoperable ORB Protocol (IIOP).

## Getting Dirty

The fourth level of WF refines the transformation of Web content into structured data for the DW. As in the previous levels, the WF activity characterizes the business relevance of Web content and establishes the infrastructure to use it.

This level's objective is to exploit the business potential of Web content as input to the data warehouse. Now comes the dirty work of structuring Web content into the proper format. The challenge is twofold: First, adding a reliable time dimension to the detailed facts. Second, linking into the proper fact or dimension tables in the data warehouse. The most frequent application will be augmenting an existing dimension table with an additional attribute. However, the most potential comes from creating new fact tables that allow exploration of external business factors.

Here are some suggestions on how to proceed: Investigate the current data warehouse. Obtain the schema definition. Understand the major fact tables and key dimensions for those tables. Dump some typical data on the main

tables. Compare the list of business factors to the warehouse schema. Note the gaps. Next, consider how external data would fit into the schema. Decide if attributes for existing dimensions should be augmented or if new dimensions for existing tables should be added. Finally, prioritize specific business factors that have the greatest potential for extending coverage for the data warehouse.

## Looking Externally

As companies look externally for their next competitive advantage, WF will become a necessary function of all DW systems. Content providers will have an economic incentive to supply reliable and quality information that is prestructured into generic warehouse schemas.

WF requires a new set of skills. It also requires an expanded infrastructure for networking and DW. Both require time to evolve into a production system. It will all come together if you work through the four WF levels I've described. ■

*Dr. Richard Hackathorn (richardh@bolder.com) is president and founder of Bolder Technology, Inc. (Boulder, CO). This article was extracted from a forthcoming book from Morgan Kaufmann Publishers. You can find a resource center for Web farming at <http://www.bolder.com/>.*

*Psion's EPOC32 OS provides sophisticated real-time services for hand-held devices. By Dick Pountain*

## A New Epoch for Hand-Helds

**Y**ou probably know Psion as a hardware vendor—the one that offers the neat Series 3 hand-held computer. Now its software division, Psion Software PLC, is actively seeking to license a new OS called EPOC32. Psion developed this object-oriented, multithreaded, real-time OS initially for its own new 32-bit ARM-based hand-held, the Series 5.

The cramped hardware environment of a hand-held computer makes designing a suitable OS tough. Hand-helds have slow CPUs and small memories, yet they are increasingly expected to handle real-time tasks and offer a robust OS. Power economy is also crucial, because hand-helds are expected to run for weeks, rather than just hours, on batteries.

EPOC32 addresses these needs by cramming features that you would expect to see only in a big-iron OS into minimal ROM space: It supports preemptive multitasking, hardware memory protection, and an innovative threading model that yields very low interrupt latency. Psion intends EPOC32 to be at the heart of future generations of smart telephone and communicator products, which means real-time performance is of the essence.

As the screen on page 46 shows, the Series 5 implementation of the EPOC32 OS includes a full set of personal productivity applications—word processor, address database, sketch pad, diary, world clock, alarm, and sound recorder—that run under a pen-navigated GUI called EIKON. The EIKON interface is built as a clearly separate layer on top of the core OS. This setup allows you to replace the EIKON interface with a fully custom GUI while still reusing the underlying font, bit-map, and rich-text abilities.

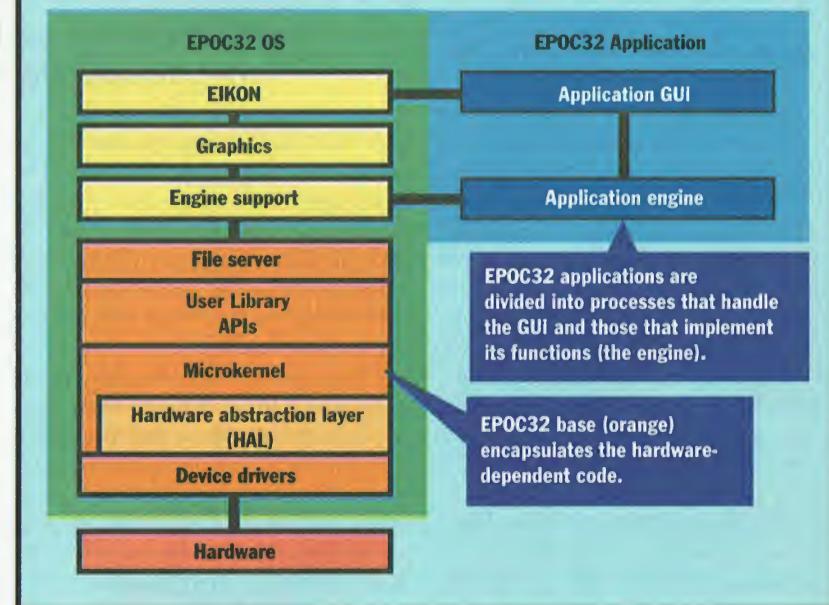
### Clients and Servers

EPOC32 is built on thoroughly modern design principles using a microkernel, a

client/server structure, and object orientation. The kernel provides basic system-wide services, such as memory allocation, thread creation, semaphores, and timers. Some higher-level services are provided directly from the I/O device drivers via an

A scaled-down version of EPOC32, used in embedded applications, still provides the core OS services but limits the system to a single thread of operation. This restriction provides increased speed and reduced interrupt latency, which can

### EPOC32 OS Architecture



**Much of the EPOC32 OS code can be simply  
recompiled for any processor.**

object-oriented User Library API. All other EPOC32 services are provided by system threads acting as servers, which run as separate processes outside the kernel.

The Psion Series 5 implementation includes 10 such servers, among them window, file, database, communications, and font/bit map. A key feature of EPOC32 servers is that they are responsible for cleaning up all resources used by their clients—after both normal and abnormal termination—to avoid resource leaks.

be important in a real-time embedded system application.

### Threads and Superthreads

EPOC32's kernel exploits ARM's memory-management unit (MMU) hardware to provide a separate address space for every process running in the system. Threads are preemptively scheduled within these processes. The kernel executive runs in privileged mode and has access to all parts of the system.

*continued*

Unprivileged user (i.e., application) threads must access all services via the kernel server. Applications are not allowed to directly access the system hardware, I/O, or interrupt hardware. This architecture allows EPOC32 to run with interrupts enabled almost all the time—and thus be very responsive to interrupt requests. A null thread, which runs only when there's nothing else to do, controls the ARM's power-saving circuitry.

For the very lowest latency tasks, EPOC32 provides "superthreads" that run on the kernel side and allocate their own resources without going through the kernel server. Such a task might be a GSM satellite phone application, where certain events require a response within milliseconds, with a permitted tolerance of just a few hundred microseconds.

A communication that crosses process or thread boundaries is expensive, and EPOC32 servers use tricks to minimize this: Multiple processes aren't allowed simultaneous access to the same data file; the window server queues requests and executes them in batches; the font server shares its heap so clients can BIT-BLT directly from it; and all communications servers run within the same process.

EPOC32 uses an innovative asynchronous model for kernel and I/O service requests. To avoid power-wasting polling loops, each server spawns an "active object" that manages a request and waits on its completion. In effect, these active objects offer nonpreemptive multitasking within a single thread, so few applications or servers ever need spawn more than a single thread. A word processing application, for example, reads keyboard and pen input, reformats text in the background, and updates the state of GUI controls, all while concurrently using active objects within a single thread.

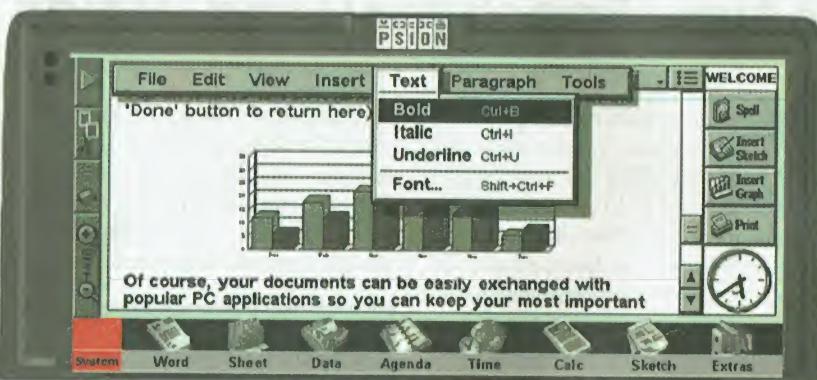
## Engines, Objects, and Embedding

All EPOC32 applications divide cleanly into an "engine" that provides the application's basic functions and a separate GUI that drives it, as shown in the figure on page 45. Applications access their data only via the engine's API methods, never by direct knowledge of its file format. An important EPOC32 module provides support services for application engines and their GUIs, in addition to two core data models—the stream store and the text content.

Stream stores underlie every data structure in EPOC32: files, the clipboard, even the undo buffers. Each application's persistent data is a collection of streams (text, sound, or bit maps) linked by pointers and contained within a single store. This is similar to Microsoft's Structured Storage, except that it's built into the heart of EPOC32 right from the start.

since Win32 supplies all the graphics and file services.

All EPOC32 file-server references are mapped to a designated "safe" area on your hard disk to ensure that buggy development code can't touch your PC files. You can use WINS to develop EPOC32 applications in C++ with standard Microsoft Visual C++ tools and run them



The EIKON user interface has fixed icons around the screen for rapid selection and task switching.

EPOC32 uses its engine-support layer to build several higher-level "views." The Text view provides a user interface for displaying, editing, and formatting rich text; the Chart view provides business graphics, such as bar and pie charts; and the Grid view is a rich text grid that underlies the spreadsheet.

These views provide images for printing as well as for screen display. By reusing them, you can make any application truly WYSIWYG with negligible programming effort. To make a new application able to embed pictures and sounds, you just use a Rich Text view as one of its components. EPOC32 embedding is limited compared to OLE: You can edit embedded documents in place, but you can't embed previously created documents. A future release will overcome this limitation by adding a linking mechanism based on HTML.

## Developing for EPOC32

EPOC32 is intended for final deployment only on ARM7- and StrongARM-based platforms. Psion has built a simulator program, called WINS, that uses the actual EPOC32 code to emulate EPOC32's behavior in a screen window under Windows NT or 95. Only the EPOC32 kernel's hardware abstraction layer (HAL) needed to be rewritten for the Intel x86 CPU,

directly in the emulator environment. Once your application is fully debugged, you perform a final cross-compile onto the ARM using a tool set based on GNU C++. Later this year, Psion will release OVAL for EPOC32, a Windows-based rapid application development (RAD) language environment that's much like Visual Basic.

## WHERE TO FIND

Psion Software PLC  
London, U.K.  
+44 171 208 1800  
<http://www.software.psion.com/>

Psion hopes that this easy development path will help it to license EPOC32 not only to other hand-held computer manufacturers but to vendors of set-top boxes, mobile telephones, and communicators. Launching a new hand-held OS that competes with Microsoft's Windows CE takes a lot of confidence, but Psion has reason to be confident in this arena: According to Forrester Research, the Series 3 is the hand-held market leader, with a 33 percent share and worldwide sales of more than 1 million units. ■

*Dick Pountain is a longtime BYTE contributing editor based in London. You can contact him at [dickp@bix.com](mailto:dickp@bix.com).*

New IP-switch designs help move low-latency data such as sound and video through large networks. By Mick Seaman

## Smarter and Faster IP Connections

**N**ot so long ago, 80 percent of all network traffic was contained within common subnets. Today, the phenomenal growth of the Internet and business intranets has dramatically increased the amount of traffic that must be routed among separate subnets. Furthermore, network administrators who once had to worry far more about the reliability of data and little about when it arrived are now faced with demands for bidirectional audio and video. In these examples, it's expected that there will be a small, acceptable data loss, but the issue of when this real-time data arrives at the desktop via increasingly busy networks has become vital.

Unfortunately, current routing technologies are not suitable for cost-effective, multigigabit low-latency traffic. This means that most LANs use switching as the basis for high-speed traffic among subnets on a local network, but they use slower routers for moving data among subnets on different LANs. Thus, as data moves among subnets (an ability made possible by the routers), it can face unpredictable delays.

For these reasons, network managers want to design their LAN infrastructures on high-speed-switching architectures, because switches provide wire-speed forwarding between separate LAN segments while creating a single logical LAN between end systems. New solutions being brought to market by two leading network suppliers aim to provide the control-policy functions of routing with the wire-speed performance of switching.

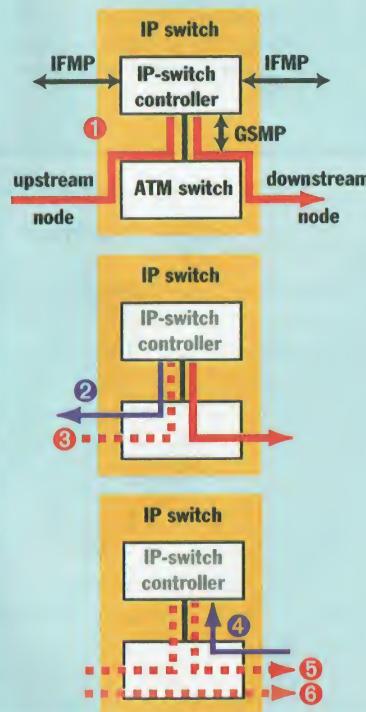
### IP Switching

Ipsilon's IP Switching establishes virtual circuits that bypass routers' Open Systems Interconnection (OSI) network level 3 layer using flow-matching techniques. In IP Switching, which is targeted at asynchronous transfer mode (ATM) networks,

each IP node sets up a virtual channel on each of its ATM physical links to be used as the default forwarding channel. An ATM input port inside each switch receives incoming traffic on this default channel and sends it to Ipsilon's intelligent

The switch then performs a decision-making process to determine whether a flow should be routed or switched to a high-speed ATM virtual circuit. For a time-critical flow, the switch controller establishes a virtual circuit, eliminating

### Ipsilon's IP Switching Mechanism



① Packet is forwarded over default ATM virtual channel (VC). IP-switch controller classifies the packet's flow.

② IP-switch controller notifies upstream node to use a new VC.

③ Packets begin moving on the new VC, and the stream is labeled.

④ Downstream node requests new VC for the flow.

⑤ IP switch sends downstream flow on new VC and labels the flow.

⑥ IP switch maps upstream flow's ATM port to that of the downstream node's ATM port, bypassing the controller.

*Ipsilon Flow Management Protocol (IFMP)* associates data flows with certain ATM virtual channels.

*General Switch Management Protocol (GSMP)* gives the switch controller access to the ATM switch hardware.

You can send low-latency data directly through an ATM virtual channel, bypassing the IP controllers.

gent routing software in its switch controller. In addition to forwarding the packet over the default channel, the switch controller identifies the flow. A flow is a sequence of packets with the same point of origin, the same destination, the same protocol type, and other common characteristics.

the need for further router processing, as shown in the figure "Ipsilon's IP Switching Mechanism."

While this architecture does result in performance improvements, there are several potential drawbacks to Ipsilon's switching solution. First, the architecture involves moving the router aside in favor

of the Ipsilon switch controller, all in one step. Network managers may be unwilling to make such a change with the core piece of their networking infrastructure.

Second, there's IP Switching's flow orientation. While opening a virtual circuit makes sense in many cases, the technology relies on predictions from the switch controller whether to establish the circuit. For relatively small data transfers, opening the virtual circuit may not be worth the overhead that creating the virtual circuit imposes.

Finally, IP Switching is suited only for ATM network architectures. Few LAN backbones are solely ATM-based. Therefore, Ipsilon's IP Switching technology is suitable for only a small segment of the marketplace.

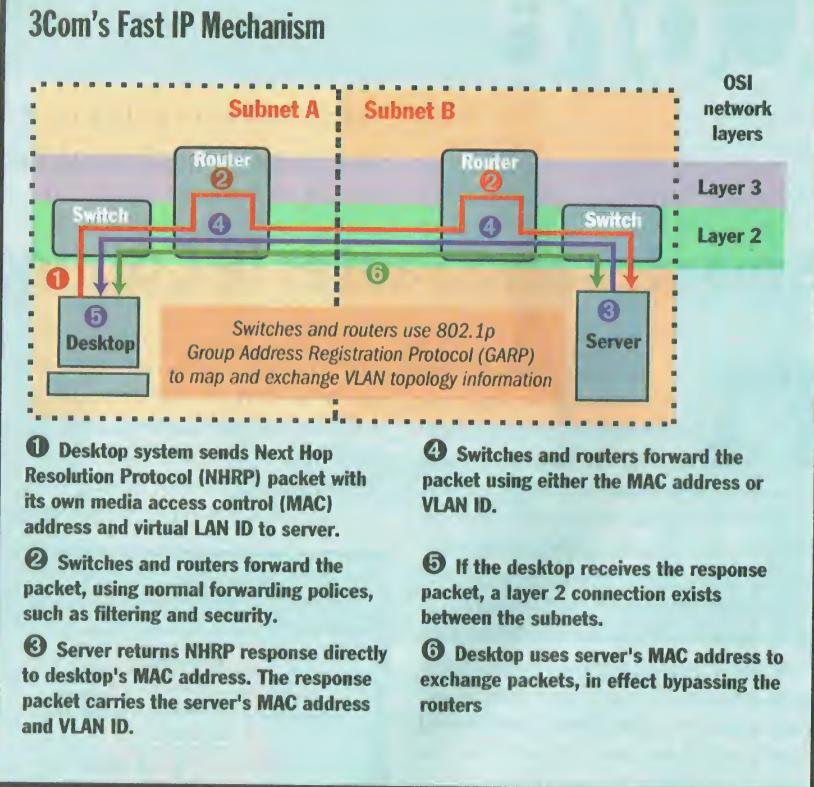
## Fast IP

The Fast IP protocol from 3Com (the author is an employee of 3Com) offers the performance of switching with the control of routing over all types of network backbone technologies, including Ethernet, Fast Ethernet, Gigabit Ethernet, Fiber Distributed Data Interface (FDDI), Token Ring, and ATM OC. Fast IP is applicable in both packet- and cell-based networks.

Fast IP is different from other IP-switching solutions in that it is initiated at the desktop, not in a router or switch. By equipping desktops and servers with the means to tell the network what they need and when they need it—and then explicitly tagging the associated frames—networks can implement the required quality of service policies without guessing or compromising performance by having to examine details in frames. Fast IP also reduces the number of layer 3 routing hops wherever possible, thus maintaining network simplicity and speed, and reducing latency.

A Fast IP connection begins at the desktop system through a Next Hop Resolution Protocol (NHRP) request and response technique. NHRP uses source and destination media access control (MAC) addresses to establish a layer 2 connection. It also optionally uses tags defined under the IEEE-802.1q "Draft Standards for Virtual Bridged LANs," known as Group Address Registration Protocol (GARP).

The desktop addresses its first packet to the layer 3 router. The router forwards the packet to its destination, while applying



## Fast IP uses standard network protocols to establish a layer 2 network link for low-latency data.

ing common filter/firewall policies. When the server receives the packet, an NHRP response is sent via layer 2 directly to the originating desktop's address. If the response packet reaches its destination, it indicates that there is a directly switched path to the server. The desktop then uses the server's MAC address to communicate via layer 2, bypassing the routers, as shown in the figure "3Com's Fast IP Mechanism." If the response is not received, the data flow continues to be routed as before.

In addition to simplifying management and enhancing speed by bypassing routers, Fast IP is based on several emerging standards, including IEEE-802.1q, Internet Engineering Task Force (IETF) NHRP, and IEEE-802.1p "Draft Standard for Traffic Class and Dynamic Multicast Filtering Services in Bridged LANs."

Fast IP is an affordable solution, being software-based. Because it is initiated and controlled solely by desktops and servers, it requires no changes to switches and routers. All that's needed to achieve Fast IP benefits is to add software to the appropriate systems. Client software and sup-

port for switches will be available from 3Com in the second half of this year. Fast IP client software will be bundled with certain PC network interface cards (NICs), and you can download it from 3Com's Web site (<http://www.3com.com>).

## Migration Path

What's probably of interest to the network manager is that Fast IP offers a gradual migration path. It does not remove the router. It simply speeds up the router's performance. As mentioned earlier, it requires only software installation on the end systems (desktops and servers). No changes are necessary to the hardware or software of existing routers in the network to support Fast IP. Importantly, Fast IP interoperates with switches that don't support 802.1p, 802.1q, and NHRP. Thus, a manager can slowly upgrade the end systems without worrying about bringing down the network. **B**

*Mick Seaman is vice president and chief technical officer of 3Com's network systems operations. You can contact him by e-mail at [editors@bix.com](mailto:editors@bix.com).*

# A Reliable Internet & Intranet Solution Provider



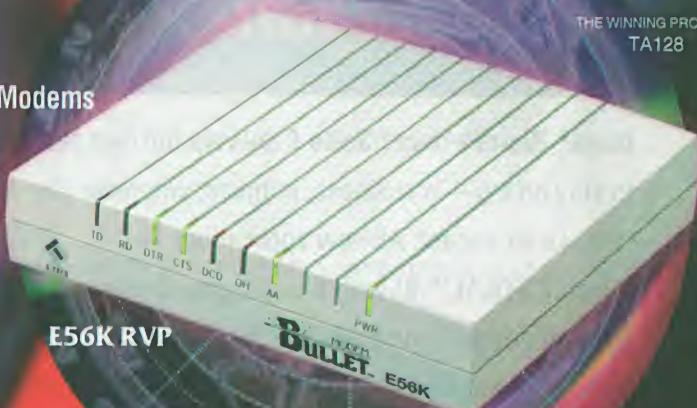
IT'S VERY WELL  
MADE IN TAIWAN

THE WINNING PRODUCT  
TA128

## 33.6 / 56 Kbps

DATA / FAX / VOICE / SVD / SPEAKER PHONE / DSVD Modems

- Rockwell K56flex technology
- Data throughput up to 115.2 Kbps
- SVD / FDSP
- DSVD ( Optional )
- Rockwell Video mode ( VRPI ) / V.80 Supported
- Plug & Play
- Wake-up Ring for PC
- Firmware Downloadable / Upgradable



## ISDN TA128

### Features

- High Speed V.24 Data Port up to 230,400bps
- Multilink PPP ( 128Kbps )
- Two Analog Ports Supported
- Flash Memory Downloadable
- Multiple Subscriber Numbering
- BACP Protocol
- V.120 and V.110 Rate Adaptation
- X.25 on D Packet Data Application



E-TECH, INC.

Headquarters  
30, R&D Road 2, Science Park Hsin-Chu,  
Taiwan, R.O.C.  
TEL: 886-3-577-4991  
FAX: 886-3-577-7751  
BBS: 886-3-577-5395  
E-mail: [service@ml.e-tech.com.tw](mailto:service@ml.e-tech.com.tw)  
Web site: <http://www.e-tech.com.tw>

U.S.A. Sales

47400 Seabridge Dr., Fremont, CA 94538  
TEL: (510)438-6700 · FAX: (510)438-6701  
E-mail: [sales@e-tech.com](mailto:sales@e-tech.com)  
Web site: <http://www.e-tech.com>

China Beijing Sales

TEL: 86-10-6857-9101 · FAX: 86-10-6857-9102

### PTT Approvals



See Us at

**COMDEX**  
Fall '97

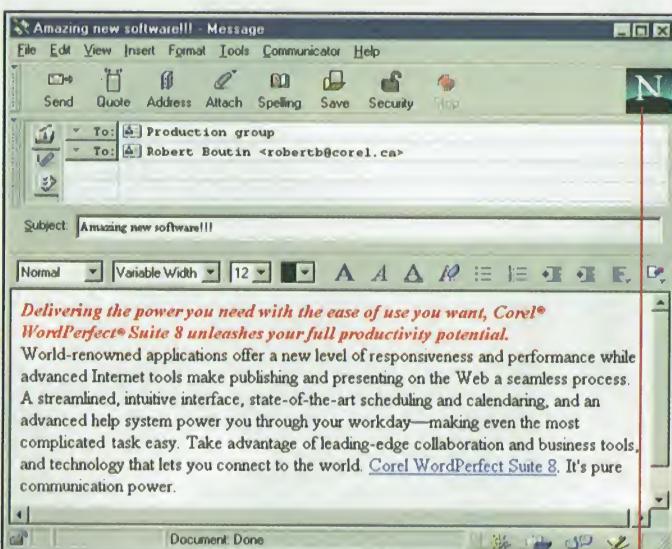
Hilton Convention Center  
H1900, Nov. 17~21

Circle 447 on Inquiry Card (RESELLERS: 448).

# Corel® WordPerfect® Suite 8 + Netscape® Communicator Fully Integrated Web & Desktop Power

Corel® WordPerfect® Suite 8 delivers the best features to stay on top—in business, at home, wherever you want to make an impact. All-new applications like

**CorelCENTRAL™ 8<sup>†</sup>** with fully integrated Netscape® Communicator—available in *both* the standard and professional versions—maximize your communication, organization and teamwork capabilities. Corel WordPerfect Suite 8—office suite technology that takes you further.



**Mailbox** – send and receive e-mail messages using open Internet standards



**Two great office suites. Outstanding communication technology.**

"The release of Netscape Communicator 4.0 ushers in an exciting new era for corporations, end users, and applications developers alike. Just as the advent of business productivity suites changed the face of the software market, so should Communicator (and soon IE 4.0) change the way corporations do business both internally and externally."

*PC Magazine, August, 1997*

"Netscape's New Browser Is The Best One Yet."  
*Fortune, May 26, 1997*

"All in all, Navigator 4.0 is the best Web browser available today."

*Wall Street Journal, July 10, 1997*

**Office Suite Excellence**

**To purchase Corel WordPerfect Suite 8, contact your local reseller.**



**OfficeMax®**  
Taking Your Savings To The Max!  
1-800-788-8080



**COREL**  
www.corel.com  
Call now for faxed literature!  
1-613-728-0826 ext. 3080  
Document # 1383

Internet connection required for many features of CorelCENTRAL 8.

\*For upgrade version only. US\$ plus applicable taxes and shipping. Dealer may sell for less. Prices may vary from store to store.

Copyright © 1997 Corel Corporation. All rights reserved. Corel, WordPerfect, CorelWORLD and CorelCENTRAL are trademarks or registered trademarks of Corel Corporation or Corel Corporation Limited. Netscape and Netscape Communicator are trademarks or registered trademarks of Netscape Corporation. The MMX logo is a trademark of Intel Corporation. All other product, font and company names and logos are trademarks or registered trademarks of their respective companies.

Circle 92 on Inquiry Card

*A Pentium-class processor rebels against current design trends with a vastly simplified microarchitecture. By Tom R. Halfhill*

## Keeping It Simple

**C**an simplicity and elegance surpass complexity at the processor level? That's what Centaur Technology is betting as it prepares to ship a new Pentium-class microprocessor, the IDT-C6. It's a stripped-down CPU that radically departs from modern trends in CISC and RISC design.

At first glance, the IDT-C6 is a simple design—one might almost say old-fashioned. It flunks almost every buzzword benchmark: no superscalar pipelines, no superpipelining, no out-of-order execution, no speculative execution, no rename registers, no reorder buffers. It doesn't even do branch prediction—the first x86 chip without that feature since 1993. At first glance, it resembles a 1980s-vintage 486.

Stranger still, the IDT-C6 is the debut product from an unknown start-up company. Centaur is a new subsidiary of Integrated Device Technology (IDT), which is a well-known manufacturer of static RAM (SRAM) chips and Rx000-series RISC processors under license from Silicon Graphics/Mips. However, IDT has not had any previous experience with the x86 architecture.

Internally, the IDT-C6 has little in common with other fifth- and sixth-generation x86 processors. Yet according to Centaur, it closely matches the performance of a multimedia extensions (MMX) Pentium when running the Winstone 97 business benchmark (37.7 versus 37.5 Winstones at 200 MHz). And as the table "Processors Compared" on page 52 indicates, it has a much smaller die size than a Pentium, which means it should cost significantly less.

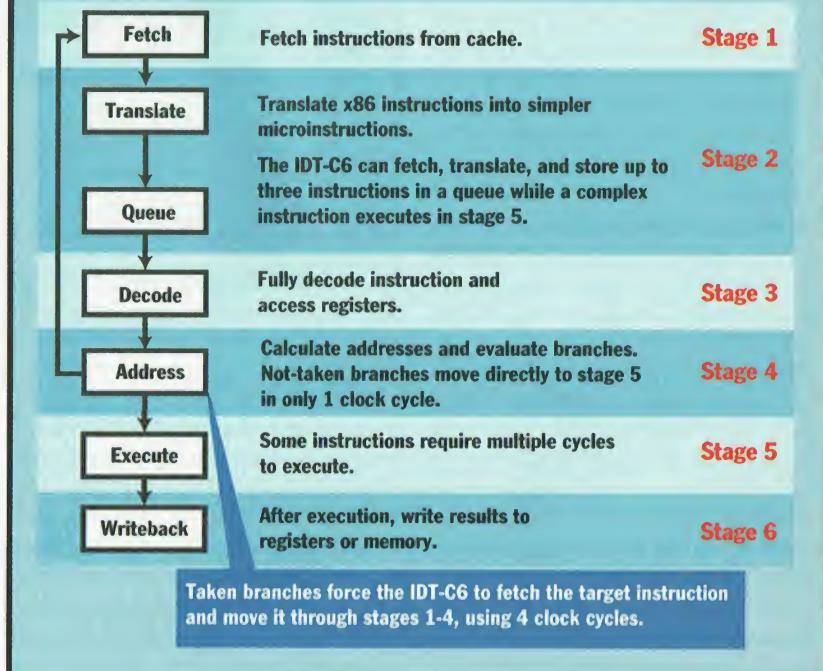
However, at this writing, Centaur had not yet announced prices, and BYTE was unable to verify the performance claims by running the BYTEMARK suite or Bapco's Sysmarks. Although Centaur was

showing samples of the IDT-C6 in May and June, final-production silicon wasn't expected until mid-August—too late to benchmark for this issue.

When BYTE does test a production

for instructions and data), high clock speeds (150, 180, and 200 MHz to start, with 225 and 240 MHz likely this fall), low power consumption (14 W maximum at 200 MHz for the desktop chip, and 7.1 to

### A Straightforward Pipeline



**The IDT-C6's pipeline resembles a 486 pipeline.**

chip, it will likely finish behind an identically clocked Pentium on the BYTEMARKS. Although BYTEMARK programs use real-world algorithms, they are still CPU-intensive synthetic benchmarks. Centaur agrees that its chip will do better with application-level benchmarks, such as the Winstone or Sysmark suites.

The reason for this is the processor's ascetic design. The IDT-C6 sacrifices raw core throughput to gain other advantages: large internal caches (32 KB each

10.6 W for the mobile chips), a tiny die size (88 square millimeters), and rapid upgrades (Centaur hopes to deliver improved versions every six to 12 months).

### One at a Time

The idea of a streamlined x86 processor has been cooking for years in the mind of Glenn Henry, Centaur's president. He is a former IBM Fellow and RISC pioneer who came to IDT by way of Dell and Mips. At his last job, Henry worked on a

hybrid RISC/CISC processor that could execute both the Rx000 and x86 instruction sets.

That project fizzled, but Henry took his ideas to IDT. In April 1995, Henry and his first three engineers sat down at his kitchen table in Austin, Texas, to sketch out the IDT-C6. They conceived a chip that had a single six-stage instruction pipeline. That alone was heresy. Virtually all of today's processors—both CISC and RISC—are superscalar devices. This means they have multiple pipelines that execute two or more instructions at once. The exceptions are low-cost embedded processors.

The decision to have only a single pipeline immediately saved millions of transistors (and the associated complexity). Superscalar processors need complex logic to control the flow of instructions through their parallel pipes. The latest CPUs—such as Intel's Pentium II and Pentium Pro, AMD's K6, and Cyrix's 6x86MX—can also execute multiple instructions out of order before retiring the results in original program order.

Centaur's chip is obviously a strict in-order machine, because it executes only one instruction at a time. That saves even more transistors, because it doesn't need a reorder buffer, rename registers, or the extra control logic to manage all that instruction shuffling.

Because of these design decisions, the IDT-C6 requires significantly less testing than a more complex CPU. "Trying to design and verify an out-of-order superscalar processor is a real problem for everybody, especially for an x86," notes Henry. "Only two years later, we're sampling our Pentium-class processor."

That's about half the time it takes to design and verify most other CPUs. Next-Gen labored for eight years on its first x86 chip. Intel is spending about five years on Merced.

## The Branch Not Taken

Raising even more eyebrows among the digerati, Henry decided to omit branch prediction, too. Although this decision eliminates a branch target buffer and other related circuitry, it appears to be an odd trade-off. Branches are so common in modern code (about one for every five instructions) that it seems as if a little extra complexity could significantly boost throughput.

To understand why the company made

this decision, take a closer look at the chip's pipeline, as shown in the figure "A Straightforward Pipeline" on page 51. It's similar to a 486 pipeline (fetch, decode, address calculation, execute, writeback) except for an additional translate stage (stage 2). During that stage, the IDT-C6 translates x86 instructions into simpler, 33-bit-long microinstructions or retrieves microcode from its internal ROM, much

emory. Centaur predicts that the IDT-C6 will save a slow memory access by pulling the address off the return stack about 90 percent of the time.

Another special feature is a cache that holds eight entries from the page-directory table, a lookup table that x86 processors use to access memory. About 90 percent of the time, the IDT-C6 finds the pointer it needs in the cache instead of

## Processors Compared

	Centaur IDT-C6	Intel Pentium (P55C)	Intel 486DX4*
Top clock speed	200 MHz**	233 MHz	100 MHz
MMX instruction set	Yes	Yes	No
MMX instruction issue	One per cycle	Two per cycle	N/A
Number of integer pipelines	One	Two	One
L1 cache (instruction plus data)	32 KB + 32 KB	16 KB + 16 KB	16 KB unified
Number of transistors	5.4 million	4.5 million	1.6 million
Fabrication process	0.35-micron CMOS	0.35-micron CMOS	0.6-micron CMOS
Die size	88 sq. mm.	140 sq. mm.	345 sq. mm.
Pin-out	Socket 7	Socket 7	486 socket
Introduction date	September 1997	June 1997	March 1994

\*The 486DX4 was Intel's most powerful 486. Earlier 486 chips (first introduced in 1989) ran at 66 MHz or slower, had an 8-KB unified L1 cache, and included only 1.2 million transistors.

\*\*The 225- and 240-MHz versions are likely this fall.

N/A = not applicable

as other x86 chips do. In stage 3, the chip fully decodes the instruction and accesses the registers. In stage 4, it evaluates branches.

If the program doesn't branch at this point, stage 4 takes only 1 clock cycle, so instructions keep flowing and life is beautiful. However, if the program does branch, the CPU must fetch the target instruction from the cache and herd it through the pipeline, which consumes 4 clock cycles. Most branches aren't taken, so the IDT-C6 averages about 2.5 clock cycles per branch.

By comparison, a Pentium needs only 1 clock cycle per branch if it correctly predicts the outcome. However, if a Pentium guesses wrong, it needs 4 or 5 clock cycles to recover. Henry calculates that a Pentium averages about 1.8 clock cycles per branch. In his judgment, the Pentium's extra complexity buys only a little more efficiency.

For all its simplicity, the IDT-C6 still has a few tricks to speed execution. The IDT-C6 has an eight-entry call-return stack. When a program branches, the CPU pushes the return address onto this internal stack. Most other CPUs would store and retrieve the address from mem-

looking in the table, which saves yet another memory access. And to keep complex instructions from paralyzing the chip's lone pipeline, the IDT-C6 also has a special queue incorporated into stage 2 that lets it fetch and translate up to three instructions while executing another instruction.

In other words, the IDT-C6 isn't as primitive as it first appears. It's not just a recycled 486 chip with MMX tacked on. Rather, it's a bold attempt to quickly produce an x86 processor that offers competitive performance at an affordable price.

"We're going to get hit by all the technical journals because we don't have superscalar pipelines and out-of-order execution and all that other stuff," says Henry. "But microprocessors ought to be commodities. Our theme was to develop a chip for the common masses. This project was my labor of love." ■

*Tom R. Halfhill is a BYTE senior editor who is based in San Mateo, California. You can contact him at [thalfhill@bix.com](mailto:thalfhill@bix.com). Additional information about the Centaur Technology IDT-C6 can be found on its Web site at <http://www.centtech.com>.*

*This language allows for the easy writing of threaded programs with bidirectional communications. By Larry Rau*

## Programming In Limbo

**L**imbo is a new general-purpose programming language developed by Lucent Technologies for writing applications that run on the Inferno OS (see "Inferno: One Hot OS," June BYTE). Limbo uses attributes from well-known existing languages as well as adding a few twists of its own. It has several features that allow for the creation of very dynamic, concurrent applications.

Limbo bucks the current object-oriented programming (OOP) trend: It contains no language features that aid in the development of OO applications. Instead, it's a procedural language that uses the concepts of modules with separate interfaces and implementations that allow developers to create well-structured applications. The Limbo language reference manual, along with the Limbo compilers, is available with the Inferno Development Kit on-line at <http://www.lucent.com/inferno>.

### Language Features

C and Pascal programmers will find that Limbo syntax looks familiar. Limbo declarations are in the Pascal style of name/colon/type, and statements and expressions are generally similar to C's in both syntax and semantics. Unlike C, Limbo contains a rich set of built-in types and is strongly typed (both static and run-time). It's also very dynamic, uses garbage collection, and offers support for threads and communications.

Limbo contains the typical primitive types—`byte`, `int`, `big`, and `real`. Unlike C, these primitives have well-defined sizes (`ints` are 4 bytes, `big`s are 8 bytes, and so on). This improves code portability across different architectures. More complex data types include arrays, strings, and the Abstract Data Type (ADT—something between a C `struct` and a C++ `class`). Limbo also contains additional

### Limbo Code Sample

#### SortExample.b

```
implement SortExample;
include "sys.m";
sys: Sys;  # declare module instance
# import sys names into current module scope
print: import sys;
include "draw.m"; #need some decls
include "Sort.m"; #bring in Sort module decl
sort : Sort; #declare mod instance var

SortExample : module
{
  init : fn( ctxt : ref Draw->Context, args : list of string );
}
init(ctxt: ref Draw->Context, args: list of string)
{
  sys = load Sys Sys->PATH;
  if ( len args < 3 )
    exit;
  args = t1 args; #ignore prog name
  alg := hd args; #declare and assign algorithm name
  modname : string;
  case ( alg )
  {
```

*continued*

high-level structured types—lists, tuples, modules, and `chan` (channels).

Arrays in Limbo are always created dynamically from memory in the heap and referred to via a reference. (References are much like C++ references for parameter passing. One of Limbo's advantages is that it does not support pointers.) Assigning an array, or passing it to a function as a parameter, passes a reference to the contents of the original array.

Along with the traditional array-index operations, Limbo also provides slicing. A *slice* is a subarray that's specified by an index range. A slice is a reference to the original array; therefore, if it's modified, so is the original array. The Limbo language reference manual provides details about various flexible forms of creating and manipulating arrays.

The ADT is Limbo's counterpart to the C++ `class`. As with C++, functions can be encapsulated with the type. However, neither inheritance nor polymorphic functions are supported. ADTs are value types; assigning an ADT results in a copy of the data contained in the original ADT. Limbo does not allow a programmer to manipulate the references themselves—only the data referred to in the references.

### Lists and Tuples

The Limbo `list` type allows for a sequence of like-typed items to be collected and manipulated. Limbo contains three list operators: `hd`, `t1`, and `:..`. The `hd` operator returns the head (i.e., first) item of the list. The `t1` operator returns the tail (i.e., the list of items following the

leads. The infix operator :: is used to construct lists. The following code fragment shows how:

```
stuff := 10 :: (20 :: (10 ::  
    stuff))  
(head, tail) := (hd stuff, tl  
    stuff))
```

This example contains a useful, yet uncommon, type called a *tuple*, which is an ordered collection of items—essentially an unnamed record. Tuples in Limbo are first-class types and can be used as variables, function parameters, and function-return values.

A unique Limbo type is the *chan* (or *channel*) type. Channels represent a synchronous bidirectional typed communications path between threads. Limbo offers a number of language features that use this very powerful type.

A communications operator (<-) sends and receives values along a channel. Limbo also provides an *alt* statement, which is similar in structure to a *case* statement. It allows for a set of channels to be given a fair chance for a send/receive operation to complete. This ensures that a single heavily used channel will not keep less

frequently used channels from communicating in a timely manner.

Channels are simple to use. Once one is created, any thread that has a reference to it can read or write to it. When a thread writes to a channel, the thread blocks until a corresponding read takes place (likewise for thread reading). This feature allows a channel to be used as a means for synchronizing threads.

Limbo programs are organized into logical blocks called *modules*, which contain declaration and implementation files. A module declaration file contains the module's exported types, constants, and functions and defines the interface to the implementation. A module implementation file provides the actual code. A module implementation can have additional types, constants, data, and functions that are considered private.

Programs explicitly load modules at run time. When a module is loaded, it's assigned to a variable that is declared to have a type of a specific module; this assignment is protected via a run-time type check. This allows instances of modules to be passed into and out of functions, as well as stored. Furthermore, multiple instances of a module can be loaded; each

instance maintains its own set of module data while sharing code.

## Threads and Communications

Limbo provides a single, simple language element—the *spawn* statement—to support multithreaded programming. This statement accepts a single parameter, which provides a function that the new thread executes. In Limbo, threads are extremely lightweight and are intended to be treated as an inexpensive, primitive resource that an application can use to accomplish a task.

The aforementioned *alt* statement allows an application's thread to simultaneously operate on multiple channels. This simple statement is a powerful feature of the Limbo language and greatly aids in creating robust and efficient concurrent applications. A single thread can block waiting on one of many channels to complete a read or write operation and then perform an action that depends on which channel completed. This statement is similar to—but is a great deal more powerful than—the *select()* and *poll()* functions used in Unix.

## A Sample of Limbo

The text box "Limbo Code Sample" contains part of a simple and contrived program, *SortExample.b*, that shows some of Limbo's features. It should help get a new Limbo programmer up and running.

*SortExample.b* has a small driver program that shows how to load one of two modules, each of which implements a different sort algorithm, thus leaving to run time which sorting implementation to use. This example is more complex than it needs to be, but it's useful for demonstrating how to use threads and channels in Limbo.

For the actual sort, a thread is spawned using the sorting function as the secondary thread. A channel is used to communicate the results of the sort back to the main thread. The main thread blocks on the channel read and thus waits until the sorting thread completes. This file, the sort modules, and the header file are all available for downloading from The BYTE Site (<http://www.byte.com/art/downloads/download.htm>). ■

*Larry Rau (Whitehouse Station, NJ) is a member of the Inferno development team. He can be reached at [larryr@lucent.com](mailto:larryr@lucent.com).*

### Limbo Code Sample (continued)

```
"Bubble" or  
"Insert" or  
"Quick" => modname = alg+"Sort.dis";  
*      => exit; #unknown  
}  
sort = load Sort modname; #dynamic module load  
# convert list of strings to array of int  
nums := t1 args; #rest of arguments  
vals := array[len nums] of int;  
for( x:=0; nums != nil; nums = t1 nums )  
    vals[x++] = int (hd nums);  
# do sort of list of integers  
ch := chan of Sort->Result; #create channel for result  
# start thread to do sort  
spawn sort->SortInts( vals, ch );  
# wait for results  
(result,err) := <- ch;  
if (err != "")  
{  
    print( "Error: %s\n", err );  
    exit;  
}  
# print numbers  
for( x=0; x<len result; x++ )  
    print( "%d ", result[x] );  
print("\n");  
}
```

# Taking Command Just Got Easier



## NEW! On Screen Management

The only KVM switch with the power and flexibility to manage the most complex server rooms just got better. Now, not only can you manage hundreds - even thousands - of servers from a single location, but with our new On Screen Management, it's easier than ever. Pop-up menus make it simple to name, configure and select your attached servers on the fly.

## Multiple Users

For growing multiuser systems, the AutoBoot Commander 4xP allows up to four users simultaneous access to any attached computer. Add even more users with our expansion options, all with independent access to every computer.

## Easy Expansion for your Growing System

Designed for expansion, the 4xP allows you to easily add computers and users as your installation grows. Combine that with our extension capability, and you can locate computers and users as far as 300 feet away from the 4xP unit!



## Multiple Platforms

The 4xP is designed from the ground up to support multiple platforms: Mix and match PC, Sun, SGI, HP 9000, Dec Alpha, RS/6000, and Macs -- control them all with a single set of peripherals.

Whether you run a growing data center or the most demanding server room, the 4xP saves you valuable time, space and money. Who would have thought a command performance could be so easy?



Cybex Computer Products Corporation  
4912 Research Drive Huntsville, Alabama 35805 USA  
(800) 93CYBEX (29239) • (205) 430-4030 fax  
<http://www.cybex.com>



Cybex, the Cybex Logo, AutoBoot, Commander and 4xP are trademarks or registered trademarks of Cybex Computer Products Corporation. PC, Sun, SGI, HP, Dec Alpha, RS/6000, Microsoft, Windows NT, Novel, Netware, Banyan, LANtastic and Mac are trademarks or registered trademarks of their respective manufacturers.

**Come see us at: Networld + Interop: Oct 8-10, Atlanta, Booth 3945**

Circle 93 on Inquiry Card (RESELLERS: 94).

# It does things computers weren't able to do back in 1997.

## Introducing NEC Direction™ PCs.

### The latest in cutting edge technology from NEC.

The new Direction PC from NEC isn't merely ahead of most computers. It's ahead of its time. In fact, it represents the next phase in the PC evolution. Which isn't surprising when you consider that NEC introduced the first color laptop and the first high availability workgroup servers. So call NEC NOW™ and

#### Why NEC NOW?

- The security of partnering with a company known for its technological innovations.
- The flexibility of ordering direct or through a reseller.
- The expertise of System Consultants.
- The immediate availability of competitively priced products.
- The resources of one of the world's largest computer companies.



talk to a knowledgeable System Consultant who can help you design the Direction system that best suits your needs. We'll even give you the choice of working with a highly qualified NEC reseller partner. See why, in an industry where people

struggle to stay current, NEC offers a more appealing option. Staying ahead.



pentium®  
PROCESSOR

NEC monitor with sharp color and high resolution. Available in a 15" (14" v.i.s.) or 17" (16" v.i.s.) screen.



Wavetable audio system provides clearest sound available.

©1997 NEC Computer Systems Division, Packard Bell NEC, Inc. NEC, Versa, and MultiSync are registered trademarks; VersaBay, A700, C700, C500, ESM, PortBar, MiniDock and Express5800 are trademarks, and UltraCare is a service mark of NEC Corporation, all used under license by Packard Bell NEC, Inc. Direction, VersaNote, VersaExec, and MagicEye are trademarks and NEC NOW is a service mark of Packard Bell NEC, Inc. Leasing based on typical 36-month lease with purchase option. Other lease options may be available, leasing arranged by third party leasing company to qualified customers. Prices do not include shipping or applicable sales tax, are valid in the US only and are subject to change without notice. Products and specifications are subject to change without notice. \*Product is 56Kbps capable. However, due to FCC rules which restrict power output of the service providers' modems, current download speeds are limited to approximately 53Kbps. Actual speed may vary depending on line conditions. MS, IntelliMouse, Microsoft, Windows and Windows NT are registered trademarks of Microsoft Corporation. NetWare and Novell are registered trademarks of Novell, Inc. The Intel Inside logo, LANDesk and Pentium are registered trademarks and MMX is a trademark of Intel Corporation. All other trademarks and registered trademarks are property of their respective owners.

BUILT  
TO  
ORDER

Video performance  
is enhanced by  
4MB of WRAM.

300MHz Intel®  
Pentium® II processor  
(the fastest on  
the market).



Convertible chassis  
available as a mini-tower  
or a desktop.

SDRAM for  
fast memory access.

## NEC Direction PCs A new direction in cutting edge technology.

Common Features: Mini-Tower or Desktop Tool-Less Chassis • 24X max CD-ROM • 3.5" Floppy Drive  
• Microsoft® Windows® 95 • MS® Office 97 SBE • 2 USB Ports • Microphone • Palmrest Keyboard  
and MS IntelliMouse® • 3-Year Limited Warranty with 1-Year On-Site Service • *DiracPC Satellite  
Dishes are Now Available as Upgrades on all Direction Systems*

### Direction SPT233

- 233MHz Pentium processor with MMX™ technology/512KB L2 Pipeline Burst Cache
- 7.0GB Ultra DMA Hard Drive/32MB SDRAM
- Number Nine PCI Revolution 3D, 4MB WRAM
- Altec® ACS-45 Speakers/AWE32 Wavetable Audio
- Iomega® Zip Drive
- U.S. Robotics® 56Kbps\* Data/Fax/Voice Modem
- NEC C700™ 17" Monitor (16" v.i.s.)
- \* Upgrade to NEC MultiSync® A700™ 17" Monitor (15.6" v.i.s.), add \$229
- \* Upgrade to 64MB SDRAM, add \$199

**\$2649**

Business Lease: \$95/mo.

### Direction SPT233

- 233MHz Pentium processor with MMX™ technology/512KB L2 Pipeline Burst Cache
- 4.3GB Ultra DMA Hard Drive/32MB SDRAM
- Number Nine PCI Revolution 3D, 4MB WRAM
- Altec ACS-45 Speakers/AWE32 Wavetable Audio
- NEC C700 17" Monitor (16" v.i.s.)
- \* Upgrade to Altec ACS-410 Speakers with ACS-251 Subwoofer, add \$69
- \* Optional U.S. Robotics 56Kbps\* Data/Fax/Voice Modem, add \$119

**\$2379**

Business Lease: \$86/mo.

### Direction SPT233

- 233MHz Pentium processor with MMX™ technology/512KB L2 Pipeline Burst Cache
- 4.3GB Ultra DMA Hard Drive/32MB SDRAM
- 4MB SGRAM PCI Graphics Card
- Altec ACS-45 Speakers/Integrated Yamaha Sound
- NEC C550 15" Monitor (14" v.i.s.)
- \* Upgrade to NEC C700 17" Monitor (16" v.i.s.), add \$199
- \* Upgrade to AWE32 Wavetable Audio, add \$49

**\$1949**

Business Lease: \$70/mo.

### Direction SPT200

- 200MHz Pentium processor with MMX™ technology/512KB L2 Pipeline Burst Cache
- 3.2GB Ultra DMA Hard Drive/32MB SDRAM
- 4MB SGRAM PCI Graphics Card
- Altec ACS-90 Speakers/Integrated Yamaha Sound
- NEC C550 15" Monitor (14" v.i.s.)
- \* Upgrade to NEC C700 17" Monitor (16" v.i.s.), add \$199
- \* Upgrade to Iomega Zip Drive, add \$99

**\$1789**

Business Lease: \$64/mo.

### Direction SPL300

- 300MHz Pentium II processor with MMX™ technology/512KB Integrated L2 Cache
- ATX Motherboard with 440LX Chip Set
- 9.0GB SCSI Hard Drive/64MB SDRAM
- Number Nine AGP Revolution 3D, 4MB WRAM
- Altec ACS-90 Speakers/Integrated Yamaha Sound
- Adaptec 2040UW SCSI Controller
- Iomega Zip Drive
- NEC C700 17" Monitor (16" v.i.s.)
- MS Windows NT® 4.0
- \* Upgrade to 128MB SDRAM, add \$379
- \* Upgrade Video Memory to 8MB WRAM, add \$119

**\$4229**

Business Lease: \$148/mo.

### Direction SPL300

- 300MHz Pentium II processor with MMX™ technology/512KB Integrated L2 Cache
- ATX Motherboard with 440LX Chip Set
- 6.4GB Ultra DMA Hard Drive, 9.5ms/64MB SDRAM
- Number Nine AGP Revolution 3D, 8MB WRAM
- Altec ACS-45 Speakers/Wavetable Audio
- U.S. Robotics 56Kbps\* Data/Fax/Voice Modem
- Iomega Zip Drive
- NEC C700 17" Monitor (16" v.i.s.)
- \* Upgrade to Altec ACS-410 Speakers with ACS-251 Subwoofer, add \$69
- \* Upgrade to NEC MultiSync A700 17" Monitor (15.6" v.i.s.), add \$229

**\$3499**

Business Lease: \$126/mo.

### Direction SPL300

- 300MHz Pentium II processor with MMX™ technology/512KB Integrated L2 Cache
- ATX Motherboard with 440LX Chip Set
- 7.0GB Ultra DMA Hard Drive/64MB SDRAM
- 4MB SGRAM AGP Graphics Card
- Altec ACS-90 Speakers/Wavetable Audio
- NEC C700 17" Monitor (16" v.i.s.)
- \* Upgrade to Number Nine AGP Revolution 3D, 4MB WRAM, add \$219
- \* Upgrade to Iomega Zip Drive, add \$99

**\$2949**

Business Lease: \$106/mo.

### Direction SPL266

- 266MHz Pentium II processor with MMX™ technology/512KB Integrated L2 Cache
- ATX Motherboard with 440LX Chip Set
- 4.3GB Ultra DMA Hard Drive/32MB SDRAM
- 4MB SGRAM AGP Graphics Card
- Altec ACS-90 Speakers/Integrated Yamaha Sound
- NEC C550 15" Monitor (14" v.i.s.)
- \* Upgrade to Wavetable Audio, add \$49
- \* Upgrade to NEC C700 17" Monitor (16" v.i.s.), add \$199

**\$2329**

Business Lease: \$84/mo.

To order, get a free catalog or  
find your nearest reseller call:  
Mon-Fri 8am-8pm EST

**1-888-8-NEC-NOW**  
Dept. No. BT582A [www.necnow.com](http://www.necnow.com)

**NEC**



**O**nce the unsinkable Titanic of high-speed networking, asynchronous transfer mode (ATM) looks like it might have a hole in its hull. The icebergs in this case? Inexpensive frame relay, IP WANs, and Gigabit Ethernet.

The ATM protocol stack was developed to run everywhere from the desktop to the server to the largest phone company switches. But high costs are keeping it from most desktop systems. And thanks to the rise of Gigabit Ethernet, there will be no shortage of bandwidth among servers.

That leaves the traditional argument for using ATM: to collapse many different networks—voice, video, and data—onto a single backbone. But ATM doesn't look like the only way to do even that anymore. Instead of ending up as most things to most people, ATM will turn out to be some things to some people—particularly phone com-

panies that have already climbed the ATM learning curve. The increasing speeds at which frame relay runs, along with the promise of new IP services such as guaranteed bandwidth and voice over frame, are challenging ATM's assumed dominance as a public WAN service. Furthermore, frame relay is based on IP addresses, whereas ATM's addressing scheme is based on ISDN phone numbers. With IP-based services at the local exchange carrier and offered by many Internet service providers (ISPs), it will be difficult to "dial" others using an ISDN-based system they aren't subscribed to. The growth of frame relay, coupled with new technologies to speed packet services and counter congestion, promises to preserve familiar IP addresses and routing protocols (such as OSPF) instead of forcing a migration to whole new schemes.

If you haven't yet implemented the technology, and especially if you're not a phone

company, the bottom line is this: Get ready for an explosion of reasons not to incorporate ATM into your customer premises equipment (CPE). The age of IP dial tone is at hand.

## ATM and Frame Relay

If you thought ATM was the only way to get a high-speed WAN connection, think again. Frame relay is breaking through its T1 (1.544 Mbps) and T3 (45 Mbps) speed barriers. Ascend Communications is running frame relay at 155 Mbps in its lab today, according to Dick Kachelmeyer, the company's director of product marketing.

Thanks to the Internet Engineering Task Force (IETF) and the Frame Relay Forum, frame relay is also gaining some decidedly ATM-like features, including voice, guaranteed bandwidth, and flow control management. One of the most important of these is FRF.11, a standard for voice over

# ATM's SHRINKING ROLE

*Internet technologies have put a hole in the boat carrying ATM to shore.*

By Scott Mace

frame relay, which the Frame Relay Forum ratified in May.

Also, by the time you read this, the Frame Relay Forum should have approved a fragmentation implementation agreement that will outline how to break frame relay frames into smaller frames. This agreement will give frame relay even more ATM-like capabilities, such as quality of service (QoS) levels, which could be mapped to equivalents in ATM hardware through interworking, says Larry Greenstein, vice president of technology for the Frame Relay Forum.

Also this year, the Forum hopes to finalize service-level agreements (SLAs). These would let carriers describe their services to users, then let those users measure the service they're getting to determine if they're getting what they pay for. While frame relay's existing committed information rate (CIR) is a way of determin-

ing the minimum rate at which frames get sent over a connection, SLAs could let customers or carriers specify the number of frames that could be discarded over a given time period, and provide customers with financial refunds if that number is exceeded. Despite concerns that the new standards would require frame relay hardware to be upgraded, manufacturers such as Ascend Communications say the new features will require only a software upgrade. In fact, Ascend plans to release its version ahead of the standard, then upgrade to meet the standard when it's completed.

So, think it's time to jettison ATM for frame relay? Not quite. For starters, OC3-speed (155-Mbps) frame relay has a long way to go: Ascend has to announce and deliver products before service providers can roll out the technology. Moreover, the Frame Relay Forum group isn't working

## EXTENDING THE ENTERPRISE

### ATM's Shrinking Role

58

### Preparing for Gigabit Ethernet

63

### Batter Up for Broadband

71

### Tested: Fast Modems

76

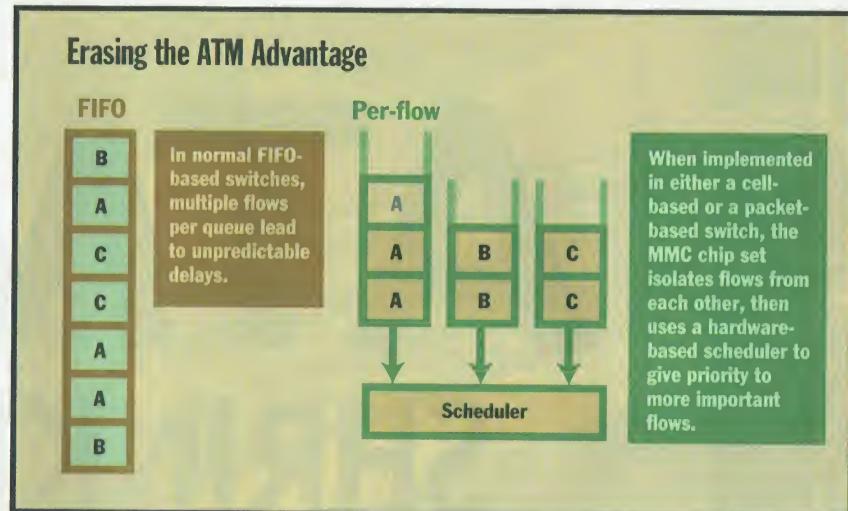
on any standard frame relay speeds beyond T3.

Second, voice over frame relay isn't ready for widespread use over public networks yet. "If the network experiences peak traffic and congestion, voice doesn't perform so well," says Heidi Brandt, senior product marketing manager at Ascend Communications. It's mostly useful for intracompany voice traffic today, she admits. Carriers such as Bell Atlantic hope to announce voice over frame relay services by the end of this year.

"Today, if you allow a large LAN traffic frame to go in between voice frames, it will obviously affect quality," according to John Rolfe, senior product manager for frame relay at Ascend. Fragmentation will help frame relay reduce latency and deliver advanced services—even video, Rolfe says.

When you get down to it, voice is just plain tricky. Even ATM still has some problems dealing with voice. While some proprietary solutions, such as Fore Systems' ForeRunner VoicePlus network module, shipped earlier this year, the ATM Forum standard to provide plain old telephone service (POTS) to PC desktops still lacked a number of features at press time, including the ability for a user to hear a busy tone. The enhancements needed were headed for final ballot by early August. Even so, the proposed standard won't work with anything other than constant bit rate (CBR) ATM, which provides data at a guaranteed rate with rigorous latency control. "There are some difficult timing issues that need to be worked out" to get voice to run over ATM's more cost-effective variable bit rate (VBR), says George Dobrowski, president of the ATM Forum.

Ultimately, packet-based services are less than ideal for handling high volumes of private branch exchange (PBX) phone calls. If WAN traffic is to include PBX-to-



In MMC's Xstream chip set, packets and cells both gain from a scheduler that gives priority to time-sensitive traffic.

PBX traffic, it has to carry clocking information, the output of old time division multiplexers, across the network. "There's still a huge legacy phone system," says Ascend's Rolfe. It's a phone system that doesn't tolerate the kind of jitter, or variations in latency, common on packet networks. Unless thousands of legacy PBXes suddenly add buffering, it'll be packet networks that have to adjust.

### ATM, IP, and QoS

How will they adjust? Try IP. The future of WANs could hinge on whether anyone can figure out how to provide priority service for critical traffic. The IP camp has Resource Reservation Protocol (RSVP), an imperfect scheme at best. RSVP relies on network devices, such as routers, to make a best-effort attempt to deliver isochronous traffic, such as video. It may, however, initially be best at simply prioritizing non-time-sensitive packets that can

still live with some latency.

ATM, of course, already specifies QoS classes that can guarantee end-to-end latency. But at a price: Once an ATM switch reaches its capacity of virtual circuits, the switch refuses additional connections, and routing must again commence to carry excess traffic around the congestion.

The debate about how to end congestion in switches and routers rages. IP fans believe that new technology, such as MMC Networks' Xstream chip set (see the figure above), implemented in Cisco's new LightStream 1010 router, lets IP as well as ATM switches give isochronous traffic priority.

ATM proponents insist that it has to be done with ATM. "The average packet traveling across the Net takes 16 hops," says Dave Nelsen, senior marketing director at Fore Systems, a leading provider of ATM switches. "About half of those occur on the backbone. When you put in ATM as a replacement backbone and push the

### WAN Services Cost Comparison

Frame relay is among the lowest-cost transparent LAN services, which includes all needed customer premises equipment and access links. (Source: TeleChoice)

	Frame relay	1.544-Mbps DS1 ATM	10-Mbps native LAN service	1.544-Mbps DS1 (T1) private line	10-Mbps ATM	N by T1 private line	45-Mbps (DS3) T3 private line
Local access	\$277	\$277	N/A	\$277	\$3487	\$1662	\$3487
Service costs	\$2668	\$3578	\$5500	\$4425	\$16,202	\$26,550	\$39,843
Router interface	\$33	\$33	\$33	\$80	\$278	\$278	\$667
CSU/DSU	\$42	\$119	N/A	\$100	\$389	N/A	\$400
Inverse muxes	N/A	N/A	N/A	N/A	N/A	\$667	N/A
Management	\$833	\$833	N/A	\$833	\$833	\$833	\$833
Total monthly cost	\$3853	\$4840	\$5533	\$5715	\$21,189	\$29,990	\$45,230

# Introducing SuperClear.<sup>TM</sup>

## A monitor with an image so clear we had to trademark it.



ViewSonic

SuperClear. It's the latest advancement in screen performance and, not surprisingly, it comes from ViewSonic<sup>®</sup>, the biggest company in display technology and the leader in the 17" (various viewable) market.

### The focus is on clarity.

The .26mm dot pitch G773 17" (16.0" viewable) monitor sets new standards for image clarity. The reason is our SuperClear Screen—ViewSonic's latest engineering breakthrough that combines the exceptional focus found in high contrast conventional CRT's with the bright, vivid colors associated with aperture grille CRT monitors. The result: Absolutely the clearest, brightest images and most vivid colors available on a 17" (various viewable) monitor. At any price. Period.

### More specs, more selections, more solutions.

The G773, with 1,024 x 768 resolution at 87Hz, is perfect for general business, home and the internet.



If your work requires even higher resolutions, we're also introducing the P775 17" (16.0" viewable) monitor for CAD/CAM, document imaging and prepress applications. This new monitor offers an eye-popping 1,280 x 1,024 resolution at an amazing 88Hz refresh rate.

Model	G773	P775
CRT Screen Size	17" (16.0" viewable)	17" (16.0" viewable)
Dot Pitch	0.26mm	0.25mm
Maximum Resolution	1,280 x 1,024	1,600 x 1,280
Recommended Resolution	1,024 x 768 @ 87Hz	1,280 x 1,024 @ 88Hz

### Keeping an eye on the environment.



And, in keeping with ViewSonic's commitment to environmental concerns, both the G773 and P775 meet strict TCO '95 standards which reduce heat emissions, lower power consumption and mandate the use of recyclable parts. Compliance to TCO certification ensures that our monitors are environmentally and ecologically friendly.

To fully appreciate the clear advantages of the G773 and P775 though, you really need to see them in person.

**For the dealer nearest you, call  
ViewSonic at (800) 888-8583 ask for  
agent 1397, or visit our website at:  
[www.viewsonic.com](http://www.viewsonic.com).**



**ViewSonic<sup>®</sup>**  
See The Difference!

## Two ISPs Show How IP Challenges ATM

Consider one of the major bandwidth-hungry Internet service providers (ISPs), Media One. It's gambling that it won't have to use any ATM in its national backbone. Media One's decision is ample evidence that even in the WAN, once-unchallenged assumptions of ATM's superiority are under attack.

Instead of ATM, Media One will use "packet over SONET," a way of transporting IP packets over the Layer 1 Synchronous Optical Network, an ANSI standard for high-speed, high-quality digital optical transmission, which many ATM networks rely on. Media One

plans to offer all the snazzy new services that ATM promised to deliver, such as voice and video, all using IP over SONET.

There are various flavors of packet over SONET. Cisco Systems, whose routers built the Internet, announced in February that it is moving forward with PPP over SONET. Four months later, Cisco bought Skystone Systems, which makes chip sets to allow Ethernet/PPP and frame relay protocols to run over SONET fiber, and announced that it would incorporate Skystone technology into "next-generation Cisco products." Cisco's OC3 PPP

over SONET is working its way through the Internet Engineering Task Force (IETF) as RFC 1163. Cisco is already planning its own OC12 (622-Mbps) version.

Another ISP, Best Internet, has already ditched ATM on its redundant SONET DS3 lines and instead went to Border Gateway Protocol (BGP), a TCP/IP routing protocol for interdomain routing in large networks. "Most people use ATM because it's cheap, but it's not as useful as a direct point-to-point link," says Richard White, Best Internet's chief technical officer. "We don't do backbone routing—we let the national

service providers do our backbone for us."

But the move to replace ATM with IP is risky. Few experts predict that IP alone can become the standard transport for WANs. "There has to be an underlying packet technology under IP to build scalable IP networks," says Chuck Davin, chief technical officer of PSINet, a leading ISP. "We know from experience that the most critical factor that determines Internet application performance is not so much bandwidth as it is packet loss." These packets are often lost by congested Internet routers, Davin says.

routers to the edge of the ATM core, traffic can move directly from the access router to the egress router with no router hops in between."

As a way of eliminating the need for routers, telecommunications companies are also rushing to deliver switched virtual circuit (SVC) service for ATM. SVCs will offer ATM customers more flexible usage-based billing, and they are more affordable for lower-usage customers than permanent virtual circuits (PVCs), according to Nick Nechita, senior architect of broadband technologies and service for the New Brunswick Telephone Company (Saint John, New Brunswick). In the U.S., AT&T recently became the first interexchange carrier (IXC) to offer ATM SVC as a public service. IXCs are also widening their ATM pipes, from OC3 and OC12

today to OC48 within 12 months. This is one area where frame relay is lagging.

Both approaches have their merits. As long as the Internet keeps growing, applications that need QoS will still experience brownouts and blackouts. In fact, there's even an effort to bypass the debate not by switching all traffic but by building faster routers. Far better, critics say, to maintain the existing democratic routing hierarchy, which gracefully degrades service but does not deny it.

So, would you rather have affordable videoconferencing service with variable quality, pay for a service that could have busy signals, or just stick with pricey point-to-point systems? You may be asking that question whether you go with ATM or stick with IP on your WAN.

### Rough Seas

Even ATM's strongest proponents now concede that public WANs, including connections to ISPs, will be a mixture of frame relay and ATM. Phone companies' ATM support on their T1 lines is increasing dramatically, but ATM will still be playing catch-up to frame relay, which is already offered in practically every market.

But frame relay's lack of SVCs impacts the ability of providers to charge sensibly for it, and for customers to know what they're paying for. "It's very hard to count IP packets," says David Dorman, chairman, president, and CEO of Pacific Bell. "It's easy to count how long a circuit has been open and who opened it." The phone companies continue to push hard

for this to become a part of IP services, so Internet access can be metered instead of flat-rate. If current trends continue, by 1999 more than half of Pacific Bell's traffic will be data, not voice, Dorman says.

Despite technological challenges and slower-than-hoped acceptance, ATM represents a healthy business. Frame relay growth has slowed only to double digits, while ATM remains in triple-digit territory, according to both the ATM Forum and the Frame Relay Forum. When you add up equipment and services, both are billion-dollar-a-year industries.

Where ATM makes sense today is at the core of some very large networks. Phone companies, for example, remain bullish on ATM pushing its way to the very edge of the Internet. "ATM has traffic management capabilities, segregation, and prioritization of traffic," says Andy Schmidt, product manager for Ameritech Data Services. "It's very difficult to get that done with IP alone." Sixty percent of today's Internet traffic, including frame relay, is carried across backbones in ATM cells.

But all the value-added services ATM promises—voice, video, variable bit rate transmission—have been late in coming. The reason: ISPs are doing all they can just to keep up with demand for existing services. Bursty, Web-based Internet traffic doubles every three or four months, according to Alan Taffel, vice president of marketing at UUNet Technologies. ■

Scott Mace ([smace@dev5.byte.com](mailto:smace@dev5.byte.com)) is a BYTE senior editor in San Mateo, California.

### WHERE TO FIND

Ascend Communications	800-764-2378 650-964-2378 <a href="http://www.best.com">http://www.best.com</a>
Alameda, CA 510-769-6001 <a href="http://www.aseend.com">http://www.aseend.com</a>	
ATM Forum	
Mountain View, CA 650-949-6700 <a href="http://www.atmforum.com">http://www.atmforum.com</a>	
Bell Atlantic Large Business Services	
Arlington, VA 800-846-1200, ext. 1200 <a href="http://www.bell-atl.com/largebiz/lb_html/intwrk.htm">http://www.bell-atl.com/largebiz/lb_html/intwrk.htm</a>	
Best Internet	
Mountain View, CA	
Fore Systems	
Warrendale, PA 888-404-0444 412-772-6600 <a href="http://www.fores.com">http://www.fores.com</a>	
Frame Relay Forum	
Fremont, CA 510-608-5920 <a href="http://www.frforum.com">http://www.frforum.com</a>	

**P**undits say that Gigabit Ethernet, because of its relatively low cost and easy fit with existing Ethernet, will be adopted quicker than previous high-speed technologies such as Fiber Distributed Data Interface (FDDI) and asynchronous transfer mode (ATM). Still, if you're like most users, you're not even in the tire-kicking phase yet with Gigabit Ethernet. You're just walking around the car and flexing your toes. Here are 10 tips for users who plan to deploy Gigabit Ethernet and want to make sure their shoelaces are tied before they start kicking the tires.

## Track Interoperability Tests

The Gigabit Ethernet standard (802.3z) should be officially approved in the first quarter of 1998. However, chip makers have already spun silicon, and equipment makers are turning out products based on the evolving standard. Lacking an approved standard, vendors must prove that the present standard is workable by doing interoperability tests.

Tests were done at Networld+Interop in Las Vegas in May by 28 vendors, among them Alteon Networks, Cisco Systems, Extreme Networks, Foundry Networks, Hewlett-Packard, IBM, Packet Engines, Rapid City Communications (acquired by Bay Networks in June), and 3Com. While the tests were encouraging, they were based on the D2 draft of the standard, which was frozen in March.

Gigabit Ethernet products that vendors are releasing will typically feature new silicon and firmware/software based on the draft that was frozen in July. Fall Networld+Interop in Atlanta will provide a public forum for tests of products based on the current draft. In July, the Gigabit Ethernet Alliance, representing the industry, announced the formation of a Gigabit Ethernet Consortium at the University of New Hampshire interoperability lab. At press time, the consortium was preparing for testing at the lab this fall.

Although many of them are sworn to secrecy by their testing partners, ask vendors whom they've tested with and what the results were. Knowing whom people are testing with is important. The more

# Preparing for Gigabit Ethernet

*Like a gourmet meal, serving up the latest LAN backbone shouldn't be a rush job. Here's help.*

By Mike Hurwicz



testing being done with the product you're considering, the better. Also, you may get a sense of the overall problems with Gigabit Ethernet interoperability and problems involving particular products.

Another useful strategy when it comes to interoperability: Buy multiple network components from the same vendor. For instance, Alteon sells both a Gigabit switch, the AceSwitch 110 (OEMed by Sun Microsystems as the SunSwitch), and Gigabit Ethernet network interface cards (NICs). You know they have been thoroughly tested together, so you have one less element of interoperability to worry about.

## Find Out What 100-Mbps Ethernet Will Do

You'll probably want to compare Gigabit Ethernet-based solutions with 100-Mbps Ethernet. Start now by looking at all the available 100-Mbps solutions.

If you will be testing Gigabit Ethernet cards for servers, know what you can do with multiple 100-Mbps Ethernet cards. To save slots in the server, consider solutions such as the quad-Fast Ethernet adapter from Sun, which gives you four 100-Mbps Ethernet ports on one card. With new trunking software from Sun, you'll be able to aggregate those four ports into one channel, though you'll still need a 100-Mbps switch port for each connection.

Similarly, Cisco Systems' Fast Ether-Channel technology connects switches, routers, and servers with up to four 100-Mbps Ethernet links. You can aggregate the links or use them in redundant, parallel fashion. (Cisco will upgrade Ether-Channel to support multiple Gigabit links in the future.)

Although price/performance is a big attraction of Gigabit Ethernet, this is still a leading-edge technology. Adapter cards may cost \$1200-\$1500 or more. Switches may cost \$2500-\$3000 per Gigabit Ethernet port. Gigabit Ethernet often costs around four times more than 100-Mbps Ethernet. If you can get four times the performance, lowered management and equipment costs (e.g., fewer switch ports) may make the jump worthwhile.

What kind of performance improvement can you expect with Gigabit Ethernet? Due to the limitations of most of today's servers (e.g., CPU, bus, OS, and protocol stack), you will probably not get 10 times the application throughput you got with 100-Mbps Ethernet. A Gigabit Ethernet connection on a 7.88 SPECint95

## Adding Up the Cell Tax

When asynchronous transfer mode (ATM) switches must convert variable-length packets into fixed-length cells for transport over ATM WANs, there's a price. First, each ATM cell contains a 48-byte payload and a 5-byte header. Thus, 10 percent of the ATM "pipe" is immediately lost to overhead. But it doesn't stop there. If a cell carrying a packet gets dropped, not only must the entire IP packet be retransmitted, the other cells from the "broken" packet continue on their way. One router manufacturer, using a reasonable estimate of 31 cells per average packet, estimates that a 1 percent cell loss can translate into a 30 percent packet loss.

Foundry Networks, a Gigabit Ethernet start-up, estimates that using a reasonable frame size of 256 bytes, Gigabit Ethernet will provide a latency of 2 microseconds across the network. ATM at 622 Mbps will provide 4  $\mu$ s of latency. But Gigabit Ethernet's variable-length packets provide 93 percent bandwidth use, while ATM achieves only a 77 percent bandwidth efficiency. Thus, the actual bandwidth required to carry a 2-Mbps video stream is 2.15 Mbps for Gigabit Ethernet and 2.59 Mbps for ATM.

ATM proponents counter that today, only ATM can provide the quality of service that applications such as video streaming need. Also, ATM switch maker Fore Systems notes that adding security to IP packets imposes a 20-byte overhead per packet; if the IP traffic is primarily short packets, that could negate the cell tax in short order, Fore officials note. But if traffic is made up, as it increasingly is on the Internet, of long "bursty" packets, it's unclear just how much this could level the playing field.

Unix server can deliver three to five times more TCP throughput than 100-Mbps Ethernet before the server CPU runs out of cycles, according to tests done by Alteon.

Whether you are better off upgrading your server adapter to Gigabit Ethernet or going with a quad-Fast Ethernet card depends largely on the horsepower of the server, but also on the adapter you use. A high-end server will be able to take better advantage of the Gigabit card. Intelligent adapters, which off-load host processing functions such as TCP/IP checksum computation, can also maximize host CPU availability and increase throughput.

"Performance varies tremendously from server to server, and only testing can give you a realistic idea of what Gigabit Ethernet can really do for your applications," says Selina Lo, Alteon's vice president of product management.

When you start pushing 100-Mbps technology, testing may show that you don't have the traffic or the servers to justify Gigabit speeds. Again, multiple 100-Mbps links may be all you need for now. You can afford to wait while prices drop and the technology matures. On the other hand, with high-end servers, you may find that Gigabit Ethernet will speed things up, save you money, and simplify management, even if it delivers only half its nominal throughput.

## Check Your Fiber

The initial 802.3z standard prescribes a Fibre Channel physical layer, which means it requires fiber-optic cabling for cable runs

that are longer than 25 meters. (Up to 25 meters, there is also a shielded-twisted-pair [STP] option, 1000Base-CX. An unshielded-twisted-pair [UTP] standard is still under development. Current UTP Gigabit Ethernet products are proprietary.)

With 62.5/125-micron multimode fiber, the most commonly installed fiber in the U.S. (and the fiber used in most FDDI installations), the 802.3z standard allows runs of up to 300 meters with a short-wavelength (e.g., 850 nanometers) 1000Base-SX transceiver or 550 meters with a long-wavelength (1300 nanometers) 1000Base-LX transceiver. Single-mode fiber, which is customarily used in conjunction with long-wavelength transceivers, is good for distances of 2 to 3 kilometers.

A potential problem arises because FDDI supports 2-kilometer runs on 62.5/125-micron multimode fiber. If you have fiber that was installed for FDDI, check the length of the runs. If they're in the 300- to 550-meter range, look for Gigabit Ethernet products that support long-wavelength transceivers. If the runs are over 550 meters, you must use single-mode fiber. If you're installing cabling now, include single-mode fiber for backbone links over 550 meters.

## Plan to Recycle

What will you do with 100-Mbps backbone equipment when you replace it with Gigabit Ethernet? Plan redeployment now.

Perhaps you are still extending 100-Mbps Ethernet backbones today but expect to be deploying Gigabit Ethernet backbones in 12 to 18 months. After the

# "My business can't stop when the power does..."

*Back-UPS® Office™'s instant battery back-up can keep you up and running even when the power goes down.*

only  
**\$179.99**  
list price

... I rely on  
**Back-UPS® Office™ from APC.**



"I've got Back-UPS® Office™ from American Power Conversion. Back-UPS Office combines world class surge protection, a \$25,000 equipment protection guarantee\* and instant, uninterruptible battery back-up power.

So when the power goes out, and it will... I have plenty of time to save what I am working on and shut down safely.

Plus, I am protected from surge damage, keyboard lock-ups, data loss



Look for APC power protection products - starting at \$24.95

PC Connection  
800-800-1111

STAPLES  
800-227-7171

MICRO CENTER  
800-227-7171

COMPUTER DISCOUNT WAREHOUSE  
800-334-4239

**\$30 REBATE**

With the Purchase of a  
Back-UPS Office

between August 1 and October 31, 1997.

You can download redemption card from our Web Site at [www.apcc.com/english/promo025.htm](http://www.apcc.com/english/promo025.htm) or visit local retailers below for more info.

**FREE** Consumer Catalog



YES! I'd like to receive my FREE catalog.  
 NO, I'm not interested at this time but please add me to your quarterly newsletter mailing list.  
Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Company: \_\_\_\_\_  
Address: \_\_\_\_\_  
City/Town: \_\_\_\_\_  
State: \_\_\_\_\_ Zip: \_\_\_\_\_ Country: \_\_\_\_\_  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
Brand of UPS used: \_\_\_\_\_ # \_\_\_\_\_  
Brand of PCs used: \_\_\_\_\_ # \_\_\_\_\_  
Brand of Servers used: \_\_\_\_\_ # \_\_\_\_\_

**APC**

888-289-APCC x8251

Fax: (401) 788-2797

[www.apcc.com](http://www.apcc.com)

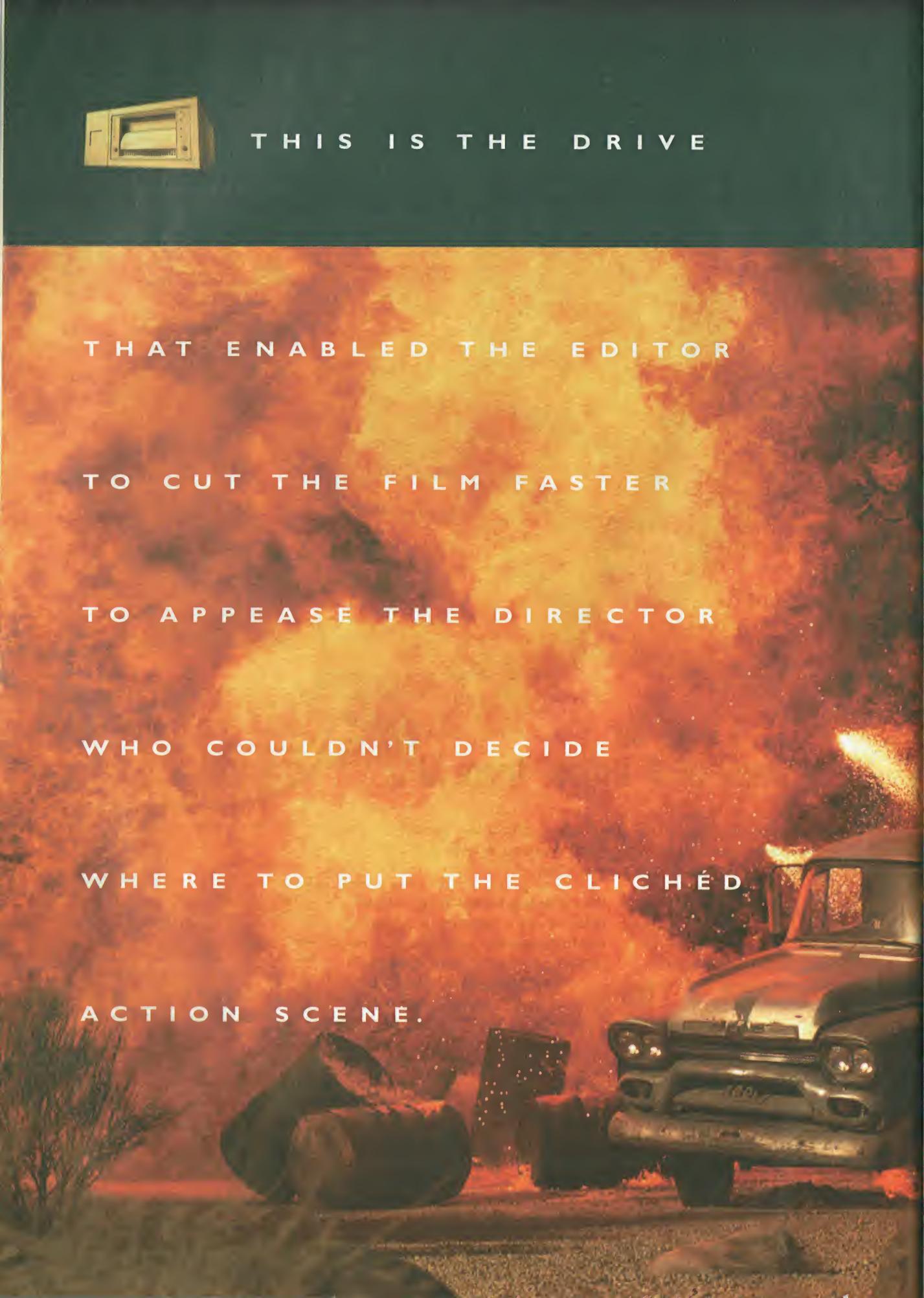
A2-B0

©1997 APC. All Trademarks are the property of their owners. \* See policy for details. BF20EF • (800)347-FAXX PowerFax • E-mail: [apcinfo@apcc.com](mailto:apcinfo@apcc.com) • 132 Fairgrounds Road, West Kingston, RI 02892 USA

*APC has won more awards for reliability than all other UPS vendors combined.*



Circle 104 on Inquiry Card.

A vintage car with its headlights on, parked in a dark, fiery landscape. The background is a dramatic, orange and yellow fire. The car's headlights illuminate the scene, and its front grille is visible. The overall atmosphere is intense and cinematic.

THIS IS THE DRIVE

THAT ENABLED THE EDITOR

TO CUT THE FILM FASTER

TO APPEASE THE DIRECTOR

WHO COULDN'T DECIDE

WHERE TO PUT THE CLICHÉD

ACTION SCENE.



© 1996 Quantum Corporation. The Quantum logo and DLT™ are trademarks of Quantum Corporation. All other trademarks and registered trademarks are the property of their respective owners.

In Hollywood, time is money. And when an editor is faced with storing and archiving film, nothing takes longer. (Except watching a Civil War documentary.) But fortunately, there's the Quantum DLT™ tape drive. It has a screaming 5MB/sec. transfer rate and a massive 35GB of capacity (native). That's 65% better performance and 40% more capacity than our competition. Which may explain why Avid Technology,® (a leader in editing equipment) offers Quantum DLT tape drives for their editing systems. For a free DLT Technical Information Kit on our full DLT line, call 1-800-624-5545, extension 131 or visit us at <http://www.quantum.com>. For an action film where the hero blows up but never gets hurt, visit your local video store.

**Quantum®**  
CAPACITY FOR THE EXTRAORDINARY™

coming of Gigabit, 100-Mbps Ethernet backbone switches may be reassigned to workgroup LANs.

## Consider ATM Replacement

You're probably not in any rush to throw away ATM equipment that's doing an adequate job or to replace it with new and largely untested Gigabit Ethernet. However, there are arguments for migrating toward a purer Ethernet environment over the long run. Management will be simplified. Equipment that supports only Ethernet will probably be much less expensive than equipment that supports ATM. In addition, translating Ethernet frames into ATM cells and back again increases the latency of the network (see the text box "Adding Up the Cell Tax" on page 64).

However, there are good arguments for sticking with ATM in the long run, too. Carriers aren't offering Gigabit Ethernet WAN services yet. For now, ATM may be the best way to interface with the WAN (see "ATM's Shrinking Role" on page 58).

## Plan ATM Coexistence

If you have ATM, how are you going to integrate it with Gigabit Ethernet? The solution may involve switches, routers, multiplexers, and hubs that support both technologies.

Alteon's AceSwitch is a Gigabit Ethernet switch that will offer ATM links later this year. In addition to the ATM option, which is being jointly developed with NEC America, Alteon plans to support FDDI links. The switch offers eight half- or full-duplex 10/100 Ethernet ports, a full-duplex Gigabit Ethernet port, and a PCI option port that you can currently configure as a second Gigabit Ethernet port. The PCI port will also support the ATM and FDDI options when they are released.

## Find Management Tools

Management often lags behind when new technologies arrive, especially when they emerge as fast as Gigabit Ethernet has. Some current approaches may be hard-pressed to handle Gigabit Ethernet.

"Some tools don't work well at that speed," says Nate Walker, Cisco's product line manager for Gigabit Ethernet. "For example, an RMON probe that has to examine every packet may not be designed to do it at Gigabit speeds."

Many early products have only basic management capabilities, says Walker. "Most companies have thought about

managing the physical and media access control (MAC) layers, but some have done very little about layer 3 and switching. That's one of the risks of looking at early products."

A third-party market for Gigabit Ethernet management is emerging, however. LANQuest is trying to fill the gap with version 4.0 of Windows NT-based Net/WRx (pronounced "networks") traffic generation and analysis software. Net/WRx can generate and analyze not only Gigabit Ethernet but also ATM traffic. Its focus is capacity planning. By generating traffic using Net/WRx, the network designer can see how much more traffic the network can handle before users see a slowdown.

## Learn About Routing Switches

With high-bandwidth technologies such as Gigabit Ethernet, routing functions are increasingly likely to create a bottleneck. There are half a dozen proposals for new interswitch protocols or modifications of the IP protocol that will give customers the performance enhancements that come with layer 2 switching, while retaining the services that routers perform, such as security, traffic prioritization, and policy management.

Initially, most of these proposals target ATM, including Ipsilon Networks' IP switching, Cisco's tag switching, and the ATM Forum's Multiprotocol Over ATM (MPOA), which the ATM Forum adopted as a standard in July. For Ethernet, Bay Networks' acquisition Rapid City Communications has implemented IP routing in silicon, permitting switch-speed routing without introducing any new protocols between switches.

The concept of a switch that performs optimized IP routing is one whose time has come. If nothing else, it lets you get the speed benefits of switching without having to totally rearchitect your IP addressing scheme, as you would have to if you flattened your network architecture by just substituting switches for routers.

Unfortunately, most of the layer 3 switching technologies are immature. Products also may lack essential features. A vendor may claim that its product is a switch router even if the only routing protocol it supports is RIP. That won't do for many customers.

To prepare for Gigabit Ethernet, customers need to educate themselves about the various layer 3 switching technologies. However, you may not be able to pick a clear winner, either in the market in general or for your application.

You don't necessarily have to think in terms of picking one layer 3 switching technology, which today implies committing to a particular vendor, because standards are unfinished or too new. Nor is your only alternative avoiding all layer 3 switching schemes for the time being. Instead, you can buy only products that require no change in the routing protocol between switches.

It's also possible to deploy multiple layer 3 switching schemes. In that case, equipment running each scheme forms an *island*. Islands are connected by ordinary IP routing. You might use tag switching in an area of the network that is based primarily on Cisco routers, MPOA in an area that's dominated by Fore Systems' ATM switches, and ordinary IP for backbone extensions based on the Bay Networks F1200 Gigabit Ethernet switch (which was

How Gigabit Ethernet and 10/100-Mbps Ethernet are similar	How they differ
<p><b>Access method:</b> CSMA/CD. All devices on the network listen for transmissions first before they begin transmitting. If two devices start transmitting simultaneously, they detect this, back off, and then each begins transmitting again according to a randomly generated time interval. Each technology permits one repeater per collision domain. Most Gigabit Ethernet implementations are switched full-duplex, which uses no CSMA/CD.</p>	<p><b>New devices:</b> Gigabit Ethernet adds a new class: buffered distributors—full-duplex, multiport, hub-like devices that interconnect two or more 802.3 links operating at 1 Gbps or faster. The buffered distributor forwards all incoming packets to all connected links except the originating link. Unlike an 802.3 repeater, the buffered distributor is permitted to buffer one or more incoming frames on each link before forwarding them.</p>
<p><b>Types of products:</b> Switches, uplink/downlink modules, network interface cards (NICs), repeaters, router interfaces.</p>	<p><b>Encoding/decoding circuits:</b> Initial implementations of Gigabit Ethernet use optical components derived from Fibre Channel, an ANSI-standard high-speed interface for linking mainframes and peripherals. Gigabit Ethernet also uses Fibre Channel's 8B/10B encoding/decoding schemes for serialization and deserialization.</p>
<p><b>Frame format:</b> 802.3 Ethernet.</p>	

# Life IS FULL OF choices

SO WHY limit YOURSELF  
TO JUST ONE FLAVOR OF  
**operating system?**

NOW YOU CAN **safely**  
RUN **multiple operating**  
**systems** WITH  
**PartitionMagic® 3.0!**

Admit it, you'd like to nibble at the latest flavors of Windows 95 or Windows NT without giving up the comfort of your current operating system. PartitionMagic makes it safe and easy by allowing you to install operating systems into their own physically separate partitions. And once you've installed a second or third operating system, PartitionMagic makes it easy to switch between them using Boot Manager. So nibble away — and still play it safe, with PartitionMagic! For more information, visit our Web site at

[www.powerquest.com](http://www.powerquest.com).

"It's amazing that the computer industry managed so long without PartitionMagic."  
Esther Schindler, *PC Magazine*

"Unique, dazzling, and indispensable, PartitionMagic is a must-have program in an era of larger and larger hard disks."  
Edward Mendelson, *PC Magazine*



**Buy PartitionMagic 3.0 and get \$15 back from PowerQuest. Visit your local software reseller or call 1-800-720-0399 for details.**

Babbagge's • Best Buy • CompUSA • Computer City • Egghead  
Electronics Boutique • Fry's • J&R • Micro Center • Office Depot • Software Etc.

©1997 PowerQuest Corporation. All rights reserved. PowerQuest and PartitionMagic are registered trademarks of PowerQuest Corporation. Patent pending.

POWER  
**PQ**  
QUEST

Circle 125 on Inquiry Card (RESELLERS: 126).

formerly Rapid City's flagship product).

Clearly, that adds management complexity, but it may make sense to go with the technology each vendor favors in areas of the network dominated by those vendors. There may be only minimal management integration between these parts of the network anyway.

## Upgrade Servers

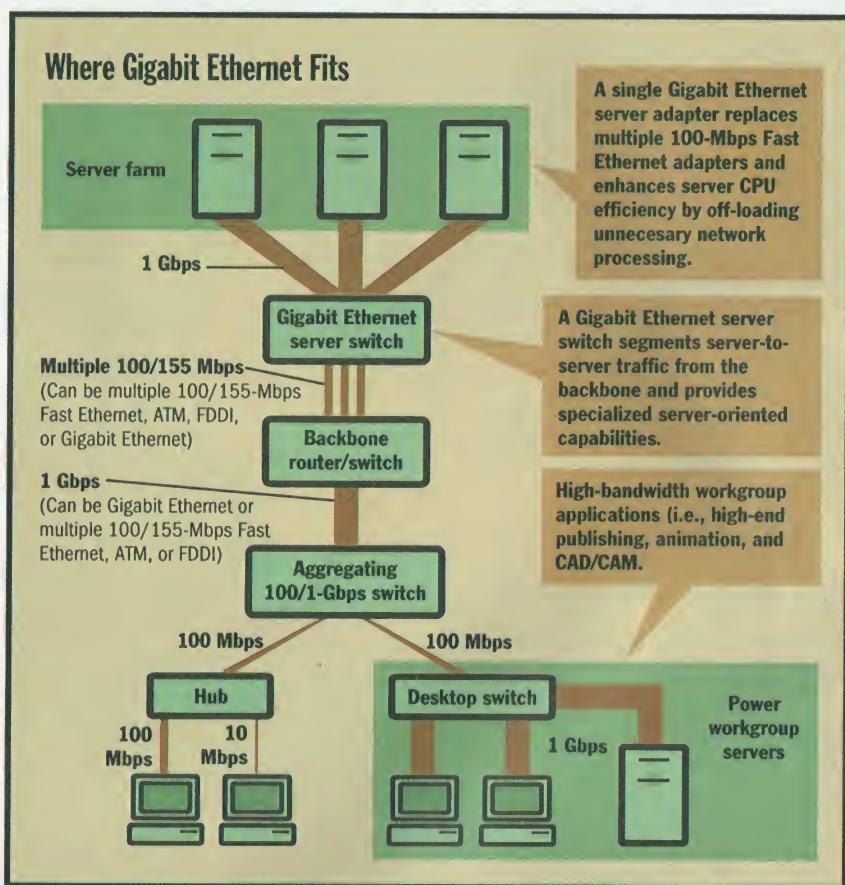
The first application that comes to mind for Gigabit Ethernet is often the backbone, where the increased bandwidth yields the most benefit for the most users. However, the backbone is also a single point of failure for the entire network. Servers can be a safer place for your first production rollouts of Gigabit Ethernet. To stay even further from the limelight, you could start by implementing Gigabit Ethernet only for server-to-server links, for functions such as backup, replication, shadowing, and synchronization, suggests Alteon's Lo. If anything goes wrong with these back-end server connections, it's less likely to have a direct and dramatic impact on users.

Server-to-server traffic is growing as fast if not faster than client/server traffic, according to Alteon. It also may be characterized by long frames that are well suited to Gigabit Ethernet technology.

If you implement Gigabit links to today's PC servers, the servers will be much slower than the network. This is an opportunity to get better performance by upgrading servers. You may just want to install faster storage. Perhaps you want to consider the Fibre Channel-based disk interfaces on Compaq's newest ProLiant servers. You can also look for Gigabit Ethernet products that target servers, such as Alteon's NICs and switches. The NICs

### WHERE TO FIND

Alteon Networks San Jose, CA 888-258-3661 408-360-5500 <a href="http://www.alteon.com">http://www.alteon.com</a>	LANQuest Fremont, CA 800-487-7779 510-354-0940 <a href="http://www.lanquest.com">http://www.lanquest.com</a>
Gigabit Ethernet Alliance Cupertino, CA 408-241-8904 <a href="http://www.gigabit-ethernet.org">http://www.gigabit-ethernet.org</a>	Packet Engines Spokane, WA 509-922-9190 <a href="http://www.packetengines.com">http://www.packetengines.com</a>
Gigabit Ethernet Consortium Durham, NH 603-862-4532 <a href="http://www.iol.unh.edu/consortiums/ge/index.html">http://www.iol.unh.edu/consortiums/ge/index.html</a>	Sun Microsystems Mountain View, CA 800-622-4786 650-960-1300 <a href="http://www.sun.com/products-n-solutions/hw/networking/sunswitch/index.html">http://www.sun.com/products-n-solutions/hw/networking/sunswitch/index.html</a>



Gigabit Ethernet makes sense as a way of linking Fast Ethernet LANs with servers and each other.

off-load protocol processing from servers; the switches offer features such as dual homing, extended frame size, and server-to-server load balancing, improving server reliability and performance.

However, even the fastest of today's PC servers can't get past the 1-Gbps data rate of the 32-bit PCI bus, which limits throughput on their network connections to perhaps 300–400 Mbps, according to Jeff Wilbur, director of hub products in Compaq's networking products division. That will change in the first half of next year, with a 64-bit PCI bus boasting a 4-Gbps data rate.

"Even Gigabit Ethernet might not be fast enough for servers with a 64-bit PCI bus," says Steven Moustakas, director of network products marketing for Sun. Sun plans to introduce servers with the new bus, though a date had not been announced at press time.

The bottom line: If you are going to give a server a Gigabit connection, consider upgrading the server to take advantage of it.

## Accelerate IP Convergence

Many Gigabit Ethernet products are optimized for IP. For instance, Bay Networks' F1200 Gigabit Ethernet switch routes only IP. Other protocols, such as AppleTalk and IPX, are bridged. Because routing functions have been implemented in silicon, the F1200 can route just as fast as it can bridge. So you can get the management and security benefits of routing with no performance penalty—but only if you feed the switch IP packets.

You can enable or disable IP routing on a per-port basis, so you can migrate to IP at your own pace. However, you can prepare to take full advantage of the F1200's capabilities by converting as many networks to IP as possible. The F1200 has six slots, each of which can support either two Gigabit Ethernet ports or 16 10/100-Mbps Ethernet ports. **B**

*Mike Hurwitz is a writer and consultant in Brooklyn, New York. You can contact him at [mhurwitz@attmail.com](mailto:mhurwitz@attmail.com).*

**I**magine this scenario: You've brought some work home. You go into your home office, turn on the computer, and press an on-screen button marked "Internet." Immediately you're connected to an Internet Service Provider (ISP) at 1.5 Mbps—about the speed of your office network's ISP connection. The ISP in turn establishes a connection to your corporate WAN via virtual private network (VPN) technology.

While the VPN portion of this equation could be rolling out now, the wide-scale rollout of various bandwidth-rich broadband technologies—based on the telephone network, cable, or even wireless—will begin late this year, with a rapid ramp-up occurring in 1998 and beyond. Road warriors may have a longer wait for the same technology to hit hotel rooms, however.

The most important new remote-access technology is Digital Subscriber Line (DSL), but it's not alone. Local Multipoint Distribution Service (LMDS), cable modems, digital satellite broadcasting, and other contenders are all still in the race. Telephone companies will deliver DSL services starting late this year; meanwhile, cable companies are continuing to roll out trials.

### DSL Diaries

DSL comes to you over standard phone cable—that four-conductor, twisted-pair copper wire that's installed almost everywhere. It carries both an analog signal for audio (a 4-kHz chunk often referred to as plain old telephone service [POTS]) and a digital signal for data. DSLs run from a telephone company's central office (CO) into a customer's building, where they're eventually connected to one or more telephones, fax machines, or modems.

Asymmetric Digital Subscriber Line (ADSL) is a specific kind of DSL developed to send video signals over existing POTS lines without needing to add to the existing copper infrastructure (see "Break the Bandwidth Barrier," September 1996 BYTE). ADSL delivers more data downstream (i.e., from the phone-company switch) to the subscriber than it receives upstream. Delivery of digital video was

# Batter Up for Broadband

*Whether wired or wireless, bandwidth is sure to hit home offices next year; road warriors will have a longer wait.*

By Mark Brownstein



once thought to require a downstream bandwidth of as much as 1.5 Mbps, although an upstream rate as low as 64 Kbps was more than enough for VCR-like control signals coming from the viewer.

Upstream data rates actually range from 16 to 640 Kbps, depending on the downstream rate, which is itself a factor of the distance from the telephone company's CO. As a result, these rates are related to the length of the copper line.

ADSL, like the other flavors of DSL, is subject to a number of limiting factors, including the distance of the user's phone from the CO (see the figure "Farther Equals Slower" on page 73). As the distance from the CO increases, the strength of the signal drops, reducing the amount of data that can be reliably received. Further obstacles include crosstalk between adjacent digital lines, line splices between the CO and the user site, loading coils that trap the signal above 4 kHz, random line noise, and breaks in the loop caused by phone jacks that aren't connected to a telephone.

According to a variety of sources, between 70 percent and 80 percent of the wired locations in the U.S. are located within the 18,000-foot ADSL transmission limit. A repeater, which amplifies the line signal, can overcome these distance limitations, making possible the delivery of ADSL to many locations beyond the 18,000-foot limit.

Delivering ADSL involves several steps. At the CO, a modem modulates and encodes signals from either the digital data provider (an ISP) or the phone company's Internet service connection, or data from a connection to a corporate network, into an ADSL signal. The modem combines the 4-kHz POTS signal with the DSL signal before sending it to the consumer over the existing phone wiring. Downstream, at the consumer's PC, a splitter separates the POTS signal from the digital signal. The digital signal is then demodulated, decoded, and passed to the PC.

Transferring data from the PC to the CO works in reverse—the modem modulates and encodes the upstream digital signal and combines it with the 4-kHz POTS signal. At the CO, the POTS signal is again separated from the ADSL digital, and the upstream signal is demodulated, decoded, and sent to the digital data provider.

Since it's a full-time digital connection, ADSL is always active. Although it uses telephone-company wiring, the connec-

## Rival ADSL Technologies

	Discrete multitone (DMT)	Carrierless amplitude/phase (CAP)
<b>Technological factors</b>	Separates spectrum into 4-kHz bands; analyzes signal-to-noise ratio in each band and changes the bit rate on each band accordingly.	Uses decision-feedback equalizer, a form of noise minimization, to maximize use of bands smaller than 1kHz.
<b>Standards</b>	ANSI and ETSI (European) standard for ADSL. A companion RADSL standard is set for approval by ANSI this fall. DMT for ADSL is moving forward as an ITU standard, but interoperability lags.	ANSI working group discussions for a standard based on RADSL are continuing; prospects for an ITU CAP standard are dim.
<b>Other considerations</b>	DMT will also be implemented in a light version of ADSL for lower-speed modems.	None
<b>Available chip sets and enabling technology</b>	ADI/Aware, Alcatel, Amati, Orckit	Globespan
<b>Chip sets and enabling technology in development</b>	Motorola, PairGain, Texas Instruments	None
<b>Installations claimed</b>	10,000 modems	250,000 modems across all DSL technologies

tion is actually a link to a network. When it's installed, the connection can be made to an ISP, to a company's high-speed network, or through the CO to an Internet connection that the CO provides. There's no dial tone, and your connection to an ISP or corporate network is hard-wired, so you won't be able to change service providers without having changes made at the phone company's CO.

The POTS signal, which is combined with the ADSL signal on one wire, is powered by the phone company. It retains power even if the ADSL line goes down or your computer is turned off. Once it enters the user's location and is split from the ADSL signal, the POTS line is a standard phone line. This issue may prove to be a challenge to some ADSL providers that have not developed the infrastructure necessary to address the high security requirements of some users.

ADSL signal-modulation methods have been a major area of dispute among ADSL hardware developers (see the table "Rival ADSL Technologies" above). Carrierless amplitude and phase modulation (CAP) was the first method applied to ADSL. CAP combines the upstream and downstream data signals, separating them at the receiving modem using echo cancellation. This method has been used successfully in V.32

and V.34 modems. "CAP is what developers of ADSL started with," says Joseph Mouhanna, manager of a research group that's evaluating broadband technologies at Microsoft. "Most of the equipment today remains CAP, but in the future, most equipment will be DMT."

DMT, short for discrete multitone, separates upstream data from downstream data. It splits the signal into separate 43-kHz carrier bands. DMT has been adopted by ANSI (ANSI T1.413) as a standard method for modulating ADSL, and the technology could be used with other flavors of xDSL as well.

CAP and DMT ADSL modems are incompatible, but until ADSL modems begin to be unbundled from services—which will occur sometime late next year—interoperability won't become a critical issue. By that time, many expect DMT to overcome CAP's early lead.

While the industry has not yet chosen a standard modulation method, the clear message is that it shouldn't matter to users. "Users should never be exposed to that stuff," Mouhanna says. "They don't see CAP, they don't see DMT—all they should see is what comes out the other end." As long as the PC and the modem at the CO use the same modulation method, xDSL should work. And since ADSL

modems won't appear in stores for two years, according to TeleChoice analyst Kieran Taylor, there's time for the standards to sort themselves out.

Other DSL variants are also being developed and/or tested. Symmetric Digital Subscriber Line (SDSL) provides upstream and downstream signals of equal size. Although SDSL's speed may not be as well suited to speedy downloads, it works well for such bidirectional applications as videoconferencing and real-time editing of code or documents.

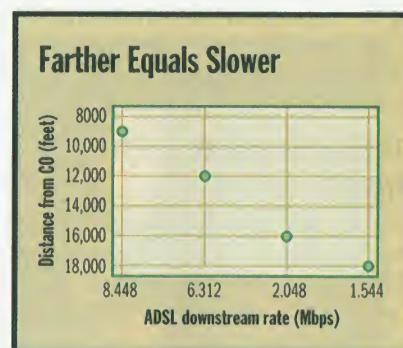
However, it's possible for phone companies and ISPs leasing copper wires to configure their switches to make ADSL behave symmetrically, although the downstream rate would drop. For instance, Pacific Bell is now talking about providing symmetrical DSL, but initially only at 384 Kbps. The rate, and the symmetrical transmission, will permit "full VHS-quality videoconferencing" for \$50 to \$80 per month, according to David Dorman, president and CEO of Pacific Bell.

Phone companies and ISPs are also studying other flavors of DSL. The capabilities and distance restrictions of the versions of xDSL now being developed are shown in the table "Comparing xDSL Technologies" on page 74.

Connecting an ADSL line to a PC is a challenge being addressed largely with standard 10Base-T Ethernet or universal serial bus (USB) connections. ADSL's high data rates preclude the use of a standard serial port. ADSL modems that are installed as internal devices handle the interfacing to the computer.

Bell Atlantic, GTE, Pacific Bell, and many small ISPs have successfully tested ADSL. The service has been deployed by a number of firms, including Signet Partners, an ISP in Austin, Texas, and Network Access Solutions, a local-exchange carrier that licenses copper lines from a regional Bell operating company (RBOC). Pacific Bell planned to deliver ADSL service to the Silicon Valley, Los Angeles, and the San Francisco Bay area by September and offer regional coverage by the end of 1998. Pricing for ADSL services ranges from \$50 to \$150 per month.

The cost of configuration is currently in the \$500-to-\$1000 range, which includes a modem at the CO and at the end user's PC. Initially, the modem is supplied to the user as part of the monthly service contract. Industry observers expect a wide-scale rollout of ADSL at the end of



ADSL bandwidth varies in response to the distance from the CO.

the year, with extremely rapid growth beginning in 1998.

### A Look at LMDS

LMDS is a recently developed technology that uses radio frequencies in the 28-GHz band. Although it's small now, LMDS seems to have the potential to quickly grow into a powerful beast.

An LMDS service provider attaches an antenna that's roughly the size of a Ping-Pong paddle to a window or a wall. This antenna is then connected to an LDMS receiver, and the digital signal flows to an interface card installed in the computer.

The extremely high frequency of LMDS limits the transmission signal to a radius of about 2.5 square miles. This short range may be one of its most attractive features. Because transmission distances are so limited, signals from antennas placed 10 or more miles apart can use identical frequencies without the risk of crosstalk or other interference problems that are common with radio frequencies that have a longer reach.

The FCC has allocated LMDS a huge frequency bandwidth: 1300 MHz. By comparison, broadcast TV uses 6 MHz of bandwidth, while cell phones use 25 MHz and broadband radios use only 30 MHz.

CellularVision America, a New York-based company that was involved in developing LMDS technology, launched its broadband data-transmission service in June. "This is not a test," insists Bruce Judson, CellularVision America's executive vice president.

The service, which was originally offered to subscribers in Manhattan and parts of Brooklyn, delivers a 500-Kbps signal downstream. The current implementation uses a dial-in modem for upstream communications. Business users

pay \$79.95 per month, with a one-time installation fee of \$225. Home users pay \$49.95 per month, with a one-time installation fee of \$199. Currently, the company's system supports only Windows 95.

CellularVision will introduce a higher-speed system in January; later, the company plans to offer two-way transmissions over the 28-GHz radio frequency. "We have the equipment to go two-way," says Judson. Before offering the service, the company will wait until the demand for two-way transmissions develops. Judson expects two-way to become economically viable in late 1998.

With all the services it plans to offer, CellularVision America will be able to serve a virtually unlimited number of customers. "Bandwidth is not a problem; we can serve the city," Judson says. "If we need additional capacity, we can dedicate additional channels, and we can also decrease the distance between cells."

The FCC plans to auction LMDS frequency for other parts of the country later this year. Meanwhile, Motorola and Texas Instruments are developing LMDS products. "LMDS could be a dark horse," says Marshall Taplinsky, vice president of marketing at Hayes Microcomputer Products. "It's elegantly simple for the consumer to hook up, and pipes will be available for everybody, so the system won't get overloaded."

### Cable Modems

The cable modem faces an uncertain future. Although technically it may satisfy the needs of many users, it may be too big a risk for many cable providers to offer this type of service.

The basic idea behind the cable modem is simple: A portion of the cable bandwidth carries data, and the cable modem extracts the data signal from the cable. Although this idea is elegant in theory, cable operators face many challenges. Cable TV's generally poor financial performance, aggravated by the loss of market share to digital satellite broadcasts (e.g., DirecTV), has forced many operators to be especially conservative about new investments.

Most cable is unidirectional; that is, it's designed to carry a video signal from a cable company's CO to subscribers' residences. A large percentage of installed cable supports downstream only. The cost of upgrading a system to bidirectional will probably delay any improvements until

larger cable companies can demonstrate an acceptable return on investment.

Even if the cable companies successfully deploy digital data services over their cables, their very success might eventually prove to be their downfall. Cable transmission requires an inverted tree topology: A large trunk carries the signal from the cable company. Branches (i.e., cables) are split off, and additional branches are further split and brought into subscribers' homes.

All users on a branch share the cable's bandwidth. If the cable can deliver 6 Mbps of data, a solitary user on a branch enjoys more capacity than he or she can use. But when you add 50 or 100 or more users on the same branch, a 6-Mbps downstream signal, divided by the number of people vying for bandwidth, may deliver data to each user only at speeds comparable to those provided by an analog modem. Additional channels might have to be added, and additional cable may have to be pulled, to deliver high bandwidth.

Microsoft recently invested \$1 billion in Comcast, a major cable-service provider. Mouhanna describes the investment as "part of an effort to jump-start broadband over the public network. The cable industry needed a little boost to make it happen."

Microsoft's involvement may go a step further. Although its acquisition of WebTV was just approved in August, there was speculation that special versions of the

WebTV box with an integral cable modem could be in Microsoft's product plans, which could boost the data transfer business for cable operators.

## Digital Satellite Broadcasting

DirecPC, a product from Hughes Communications, is an asymmetric system that delivers 400-Kbps downstream data from a satellite to a home or office dish. DirecPC relies on a telephone connection for

services. Teledesic's plan, which is backed by Bill Gates and Craig McCaw, calls for the deployment of 288 satellites. The employment of satellites for data transfer will increase significantly when the first satellites are successfully launched and become fully operational, beginning around the year 2000.

## Obtainable Today

Technologies delivering high bandwidth are here today. Within the next 18 months,

## Comparing xDSL Technologies

Technology	Downstream rate	Upstream rate	Distance (feet) (24-gauge wire)
ISDN (ISDN DSL)	128 Kbps	128 Kbps	18,000
HDSL (High-bit-rate DSL)*	768 Kbps	768 Kbps	12,000
ADSL (Asymmetric DSL)	1.5-6 Mbps	640-1000 Kbps	12,000-18,000
SDSL (Symmetric DSL)	1.5, 2 Mbps	1.5, 2 Mbps	10,000
RADSL (Rate-Adaptive DSL)	7 Mbps	1 Mbps	12,000
VDSL (Very-high-rate DSL)	13-52 Mbps	1.5-2.3 Mbps	1000-4500

\* Single-pair

Source: TeleChoice

upstream communication.

While DirecPC uses a satellite dish similar to the one used by DirecTV, separate dishes are required for the two systems. Hughes will someday offer a method for using one dish for both DirecTV and DirecPC, although no target date has been announced. Hughes has also announced a PC card that will let a PC user view DirecTV signals on a monitor. Various pricing plans range from \$9.95 per month, with a charge of 60 cents to 80 cents per megabyte downloaded, to \$129.95 per month for unlimited access. Service charges do not include ISP fees.

Another service, DirecPC/EE (DirecPC Enterprise Edition) offers transfers of up to 24 Mbps of shared or dedicated bandwidth. This service, which is available to corporate customers, can be useful for transmitting large amounts of data to field locations or other sites that are equipped with very small aperture terminal (VSAT) receivers.

Motorola, Teledesic, and a growing number of other companies have announced plans for the placement of satellites around the globe to provide point-to-point communications, data access, telephone service, video, and other ser-

availability of one or more high-speed options to homes and offices should be almost ubiquitous.

The situation for road warriors looking to obtain high-speed remote access, however, currently remains unclear. The Marriott in Washington, D.C., is installing in its guest rooms OverVoice, a system that provides connection to an ISP at 1.5 Mbps; as yet, the hotel chain hasn't said what this service will cost. According to Marriott, if the test is successful, the chain will consider expanding the service to its other hotels.

As for the phone companies, the short-term opportunity lies in allowing consumers to access corporate resources from home, says Kamran Sistanizadeh, director of network-systems engineering at Pacific Bell. "Later phases of the program on a larger scale will address small- and large-business market segments," he adds. With luck, that will put high-speed access everywhere anyone needs it. ■

*Mark Brownstein (Northridge, CA) is a writer/editor specializing in high technology. He has written five books and has been editor of three magazines. You can reach him by sending e-mail to [Mark@brownstein.com](mailto:Mark@brownstein.com).*

## WHERE TO FIND

ADSL Forum	DirecPC
Fremont, CA	Hughes
510-608-5905	Communications
<a href="http://www.adsl.com">http://www.adsl.com</a>	Germantown, MD
Amati Communications Corp.	301-428-5500
San Jose, CA	<a href="http://www.direcpc.com">http://www.direcpc.com</a>
408-879-2000	Globespan
<a href="http://www.amati.com">http://www.amati.com</a>	Red Bank, NJ
Bell Atlantic Network Services, Inc.	732-345-7500
Arlington, VA	<a href="http://www.globespan.net">http://www.globespan.net</a>
800-339-8027	
<a href="http://www.bell-atl.com/adsl">http://www.bell-atl.com/adsl</a>	
CellularVision America	Hayes
New York, NY	Microcomputer Products, Inc.
212-751-0900	Norcross, GA
<a href="http://www.cellularvision.com/speed">http://www.cellularvision.com/speed</a>	770-840-9200
	<a href="http://www.hayes.com/cable/index.htm">http://www.hayes.com/cable/index.htm</a>
	Motorola, Inc.
	Schaumburg, IL
	800-668-6765
	847-576-5000
	<a href="http://www.mot.com">http://www.mot.com</a>

Comdex Fall '97  
Nov. 17-21  
Booth S2885



New HASP Software  
V4.0 Features!  
Dynamic Driver Load  
Automatic ECP/BiDi  
Support

MORE  
DEVELOPERS  
PROTECT.

## HASP® PROTECTS MORE.

All over the world, more developers are choosing to protect their software against piracy. They're protecting more products, on more platforms, with better protection — and selling more as a result. And more of these developers are protecting with HASP. Why? Because HASP offers more security, more reliability and more features than any other product on the market. HASP supports the most advanced platforms, including Win NT, Win95, Win32s, Win 3.x, OS/2, DOS, Mac OS, NEC, UNIX and LANs. To learn more about how you can protect better — and sell more — call now to order your HASP Developer's Kit.



**1-800-223-4277**  
www.aks.com

**ALADDIN**

*The Professional's Choice*

Call your local distributor now!

■ Aladdin Russia 095 9230588 ■ Australia Comlab 03 98985685 ■ China Feitian 010 62567389 ■ Czech Atlas 02 7666085 ■ Denmark Berendsen 039 577316 ■ Egypt Zemeldien 02 3604632 ■ Finland ID-Systems 09 8703520 ■ Greece Unbrain 01 6756320 ■ Hong Kong Hastings 02 5484629 ■ India Solution 011 2148254 ■ Italy Partner Data 02 26147380 ■ Korea Daewoo 02 8484481 ■ Mexico SISoft 091 80055281 ■ Poland Systemh 061 480273 ■ Portugal Futuramica 01 4116209 ■ Romania Ro Interactive 064 140383 ■ Singapore ITR 065 5666788 ■ South Africa D Le Roux 011 8864704 ■ Spain PC Hardware 03 4493193 ■ Sweden Kordab 455 307 300 ■ Switzerland Opag 061 7169222 ■ Taiwan Teco 02 5559676 ■ Turkey Mikrobeta 0312 4670935 ■ Yugoslavia Ays 021 623928

© Aladdin Knowledge Systems Ltd. 1995-1997. (R) 97 HASP® is a registered trademark of Aladdin Knowledge Systems Ltd. All other product names are trademarks of their respective owners. Mac & the Mac OS logo are trademarks of Apple Computer, Inc. used under license. NSTL makes no recommendation or endorsement of any product. The NSTL report was commissioned by Aladdin.

### HASP Packs More Into Less.

Based on a full-custom ASIC,  
HASP packs the most advanced  
protection into the smallest key in the world.



#### North America

Int'l Office

Germany

UK

Japan

Benelux

France

Aladdin Knowledge Systems Inc. Tel: 800 223-4277, 212 564-5678, Fax: 212 564-5377, Email: hasp\_sales@us.aks.com

Aladdin Knowledge Systems Ltd. Tel: +972 3 636-2222, Fax: +972 3 537-5796, Email: hasp\_sales@aks.com

FAST Software Security GmbH Tel: +49 89 89-42-21-37, Fax: +49 89 89-42-21-40, Email: info@fast-ag.de

Aladdin Knowledge Systems UK Ltd. Tel: +44 1753 622-266, Fax: +44 1753 622-262, Email: sales@aldu.co.uk

Aladdin Japan Co., Ltd. Tel: +81 426 60-7194, Fax: +81 426 60-7194, Email: sales@aladdin.co.jp

Aladdin Software Security Benelux B.V. Tel: +31 24 648-8144, Fax: +31 24 645-1981, Email: aladdin@worldwideaccess.nl

Aladdin France SA Tel: +33 1 41-37 70-30, Fax: +33 1 41-37 70-39, Email: 100622.1522@compuserve.com

## Bandwidth on a Budget: 34 Fast Modems

**W**hen it comes to data transfer, getting it there is more than half the fun—it's the whole ball of wax. Faster is better, but selecting the best modem requires more than simply running your finger down a bar chart looking for the highest throughput numbers or the lowest price. Choosing the correct modem for your particular application means navigating your way through several competing and incompatible technologies.

In the burgeoning consumer market, 56-Kbps modems are the current frontrunner. In addition to promising higher speeds, these modems provide full backward compatibility with existing standards and a host of new features. Aimed squarely at the Internet consumer, 56-Kbps modems promise to reduce file transfer time, Internet service provider (ISP) access fees, and your telephone bill. As our tests clearly showed, however, full promised throughput is rarely, if ever, achieved.

The hype surrounding the 56-Kbps technology has engendered a number of myths and misconceptions. Although you must buy 56-Kbps modems (or upgrade existing ones), 56 Kbps doesn't require any changes to your phone lines. Vendors are quick to note that this is a significant advantage over ISDN. Unlike previous modem standards, however, 56-Kbps speeds aren't supported in peer-to-peer connections. High-speed transfer is a one-way street from service provider to user only.

Even if you choose 56-Kbps, you must still standardize on one of two incompatible proprietary specifications. U.S. Robotics, currently the largest modem

maker, was the first to deliver its  $\times 2$  56-Kbps modems. Rockwell Semiconductor Systems, on the other hand, is promoting its K56flex implementation of 56 Kbps.

Both the  $\times 2$  and K56flex camps are jockeying for top position in the standards arena. Expect most vendors to offer upgrades to the eventual single standard—many will do so for free.

The continued need for high-bandwidth connections has pushed ISDN

*Speed to 56 Kbps and beyond with  $\times 2$ , K56flex, ISDN, and ADSL devices.*

*By BYTE Editors*

bandwidth on tap—two and a half times that of even an ideal 56-Kbps connection and four times that of a 33.6-Kbps V.34 modem.

ISDN's all-digital nature allows it to provide connections that don't depend on the vagaries of the Public Switched Telephone Network (PSTN). Unfortunately, the need to provide a dedicated digital line is also ISDN's big disadvantage. Even if ISDN service is readily available at your home or office, the start-up fee, installation cost, monthly fee, and per-minute toll quickly mount, making ISDN an expensive solution for casual surfers.

One of the most intriguing and elusive data transfer technologies today is Digital Subscriber Line (DSL). Potentially, DSL makes a high-speed data channel available to anyone with a standard copper telephone line. The pervasiveness of plain old telephone service (POTS) makes DSL an attractive alternative to ISDN or cable modems. And with a DSL modem at both the phone company's central office and your location, you can receive data at speeds hundreds of times faster than the best ISDN line. Asymmetric DSL (ADSL) can provide a bandwidth from 608 Kbps to 8 Mbps to customers over a single copper loop. Additionally, upstream (customer to network) data rates of 9.6 to 944 Kbps and telephone voice service can be supported simultaneously on the same loop. Although potential data rates decrease as the distance from the central office increases, some ADSL systems can also operate over distances of up to 18,000 feet or more. This lets ADSL service be offered to most existing telephone customers.

### BYTE BEST

HIGH-SPEED MODEMS

Boosted by its outstanding performance score, the **Zoom Telephonics 2849**-

**PC** external modem took top honors, both overall and among its K56flex companions. Slightly behind the Zoom in performance but with a much better feature score, the **U.S. Robotics Courier V. Everything V.34** external modem took

first place among  $\times 2$ -based modems. Not surprisingly, third and fourth place overall went to the U.S. Robotics' and Zoom's internal counterparts, respectively.

Despite a high price, feature-richness and extreme usability let the **3Com Impact IQ** take honors among ISDN modems.

modems nearly to commodity status. While modems are available, connections often aren't. Not nearly as universal as some claim, ISDN is generally available in most major markets.

Basic ISDN service provides two B-channels, each of which can carry 64 Kbps of data or a voice call. Combine the two channels, and you have 128 Kbps of

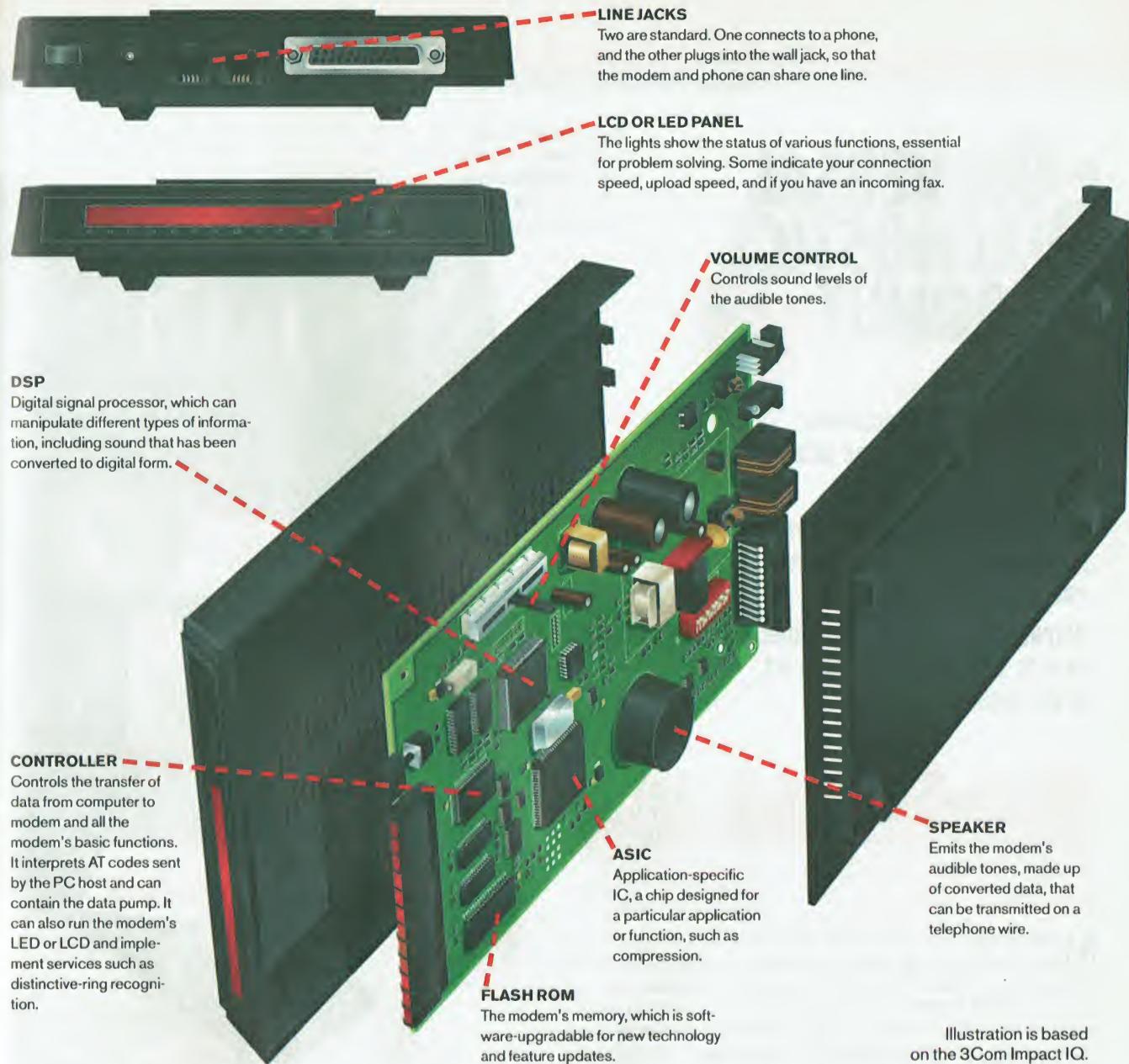


Illustration is based on the 3Com Impact IQ.

## Defining the Field

We asked manufacturers of 56-Kbps, ISDN, and ADSL modems to provide hardware for this omnibus Lab Report. The 56-Kbps modem vendors responded with enthusiasm. Thirteen vendors submitted 18 modems—eight based on  $\times 2$  and 10 based on K56flex technology. Prices of the nine internal and nine external modems ranged from a low of \$148 to a high of \$275. Of all 56-Kbps vendors in our tests, only Practical Peripherals had offerings based on both standards.

The field for ISDN modems was considerably narrower. Seven vendors submitted modems for our evaluation. Prices

for these modems were attractive—many undercut the more expensive 56-Kbps offerings. The bargain of the group sells for a mere \$195, and the pricier units will set you back \$399. There was no correlation between price and performance, although the most expensive unit also led in features and usability.

Rounding up ADSL modems proved to be the most challenging task of all. Although more than two dozen equipment makers claim to offer DSL products, only seven of them were able to produce modems for our review. Full production of these units may be as low as only thousands per quarter. For service providers preparing to commit to DSL service, this lack of

boldness should serve as a warning to go slowly when choosing high-speed modems.

Pricing for ADSL is less than straightforward. Single-unit prices ranged from \$995 to \$10,000. But the more realistic 1000-unit pricing is generally between \$500 and \$1500 per line. You'll have to hammer out volume pricing with the vendor of your choice.

### Contributors

Andy Froning, Managing Editor/NSTL  
Dorothy Hudson, Project Manager/NSTL  
Maryanne Eves, Acquisitions Editor/NSTL  
Linda Higgins, Editorial Associate/BYTE  
Michelle Campanale, Technical Editor/BYTE

# Diagnose any PC's problems fast with

## the UNIVERSAL DIAGNOSTICS TOOLKIT™



- Get the best, most accurate full-system diagnostics package for all your problem PCs.
- Low-Level Formats all hard drives including IDEs. Allows relocation of Track 0.
- Works with any PC regardless of O/S: DOS, Windows 95 & NT, O/S2, Unix, Novell, etc.

## Micro-Scope™ 6.1

UNIVERSAL DIAGNOSTIC SOFTWARE

Fully O/S independent diagnostic software...

Call for upgrade pricing & complete new features list!

**MICRO-SCOPE** Universal Computer Diagnostics was developed to satisfy the expanding need for accurate system diagnosis in the rapidly growing desktop computer market. Patterned after super-mini and mainframe diagnostic routines, **MICRO-SCOPE** runs independently of any standard operating system, and is therefore at home on any machine in the Intel world. Speed, ease-of-use, and razor sharp **ACCURACY** are a few of the advantages that arise from this system independence. **Jerry Pournelle** awarded **MICRO-SCOPE** & **POST-PROBE** the User's Choice Award in the May 1994 issue of **Byte Magazine**, saying: "You name it, this tests it. If you maintain PCs you'll love it."

◆ **LOW-LEVEL FORMAT**—Performs low-level format on all hard drives including IDE drives. ◆ **TRUE HARDWARE DIAGNOSTICS**—Accurate testing of CPU, IRQ's, DMA's, memory, hard drives, floppy drives, video cards, etc. ◆ **RELOCATES TRACK 0** on hard drives that support relocation. ◆ **IRQ CHECK**—Talks directly to hardware and shows I/O address and IRQ of devices that respond. ◆ **O/S INDEPENDENT**—Does not rely on O/S for diagnostics. Talks to PC at hardware level. All tests are full function regardless of O/S (i.e. Windows, Novell, UNIX, O/S2). ◆ **IRQ DISPLAY**—Shows bits enabled in IRQ chip for finding cards that are software driven (Network, Sound Card, etc.). ◆ **MEMORY DISPLAY**—Displays any physical bit of memory under 1 MB. Very useful for determining memory conflicts and available memory space. ◆ **AND MUCH MORE...**—We don't have enough space here for everything this software can do!

Govt. Orders: NSN-7030-01-421-6459

Call Now for Special Pricing

**1-800-864-8008**



**Loop-back Plugs**—  
9-pin serial, 25-pin serial  
and 25-pin parallel  
plugs, used for external  
I/O port testing.



# 100% accurate results...



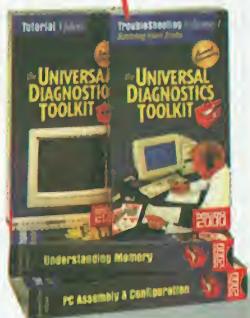
Tri-State Logic Probe—works with Post-Probe and enables testing down to individual chip level.

Durable Zip-up Leatherette Carrying Case—all your tools in one organized easy to carry toolkit.

Post-Probe Diagnostic Card—when Post-Probe detects an error, a 2 digit BIOS code will display on the card telling you exactly what's wrong with your PC. 100% compatible with all ISA, EISA, Compaq and Micro-Channel PCs.

Micro-Channel Adapter Card—(behind Post-Probe card) allows Post-Probe to be used with Micro-Channel equipped computers.

**NEW** Optional Tutorial and PC Trouble Shooting Videos—Call for titles and current prices. A wealth of technical help at your fingertips.



## Post-Probe™

First Ever Universal P.O.S.T. Card for All PCs!

**PC won't boot up? Find out why fast with our universal POST card...**



"This is the only card that will function in every system on the market. The documentation is extensive, and not only covers the expected POST Codes for different BIOS versions, but also includes a detailed reference to the bus signals monitored by the card." —Scott Mueller from his globally recognized book, *Upgrading & Repairing PCs, Second Edition*

- ◆ Includes pads for voltmeter to attach for actual voltage testing under load.
- ◆ 4 LEDs monitor +5vdc -5vdc +12vdc -12vdc.
- ◆ Monitors Hi & Lo clock and OSC cycles to distinguish between clock chip or crystal failure.
- ◆ Monitors I/O Write and I/O Read to distinguish between write and read errors.
- ◆ Accurately monitors progress of POST for computers *without* POST codes.
- ◆ Reads POST codes from any IBM or compatible that emits POST codes. ISA/EISA/MCA.
- ◆ Compatible with Micro Channel computers.
- ◆ Dip switch allows easy selection of I/O ports to read.
- ◆ Includes TRI-STATE LOGIC PROBE to determine actual chip failures.
- ◆ Manual includes chip layouts and detailed POST procedures for all major BIOSs.
- ◆ **AND MUCH MORE...**call for more details.

Govt. Orders: NSN-7025-01-421-6467

**Micro 2000, Inc.** Makers of Professional PC Diagnostic Tools

1100 East Broadway, Suite 301, Glendale, California, USA 91205

Toll Free: 800/864-8008 • Phone: 818/547-0125 • Fax: 818/547-0397

Web Site: <http://www.micro2000.com>

International Orders please call:

Micro 2000 Australia.....61-42-574-144

Micro 2000 UK.....44-1462-483-483

Micro 2000 Amsterdam.....31-206-384-433

Micro 2000 Germany.....49-69-420-8278

GSA Approved



Circle 188 on Inquiry Card.

Copyright © 1996 Micro 2000, Inc. All Rights Reserved.



**M**odems based on 56-Kbps, ISDN, and ADSL technologies are so different that separating the products according to their underlying technology clearly makes sense. Within those categories, we applied different criteria based on the technology's maturity.

## Off-the-Shelf ISDN

In keeping with our view of ISDN modems as commodities, we reduced the weight given to performance to 50 percent. Because ISDN modems have a reputation for being difficult to install and set up, we based 30 percent of the overall score on each modem's usability rating. We allocated 20 percent of the overall score to the modem's feature set.

The leader in the ISDN category was the 3Com Impact IQ. Although its performance was a few percent shy of the Arescom Flash 200, the performance leader, the Impact IQ more than compensated for it in other categories. The Impact IQ tied the U.S. Robotics Courier I-Modem w/V.Everything for top score in features. But the Impact IQ's high usability rating put it over the top as the clear winner in its category.

Although it delivered performance, usability, and features, the Impact IQ tied

as the most expensive of the ISDN modems—\$399. If you're willing to invest some time and effort during installation and setup, however, the \$195 Flash 200 can cut your equipment costs in half without compromising on performance.

## Double or Nothing

In the 56-Kbps arena, we did see quantifiable performance differences between the two varieties of 56-Kbps technologies as well as among the modems using each technology. Because performance varied—and fell short of advertised speeds—we put a 70 percent emphasis on data throughput under both clean and impaired conditions. Usability, still an important issue when adding or upgrading modems, accounts for 20 percent of the overall score. Features, mainly a function of which chip set the manufacturer uses, have a 10 percent weighting.

Because the two 56-Kbps encoding technologies, x2 and K56flex, are incompatible, we chose a Best Overall from each camp. Even so, the top four overall winners were simply internal and external versions of the same two modems.

The K56flex winners were the external and internal versions of the same modem: the Zoom Telephonics 2849-PC. The Zoom external version produced

our top performance score among all modems, regardless of technology. Performance for the internal version lagged about 10 percent behind its external twin, putting it fourth overall. Solid usability and feature scores helped ensure both modems a first-row finish.

If you're looking for an x2 modem, we suggest either the internal or external version of the U.S. Robotics Courier I-Modem w/V.Everything V.34. Both Couriers turned in top performance scores among x2 modems, with the faster Courier external modem placing about 6 percent behind the K56flex speed champ. The Couriers' top feature scores helped balance out their relatively low usability ratings.

## Adolescent ADSL

Representing the new kids on the block, ADSL modems turned out to be too slippery to pin down. Standards, test requirements, and feature sets for all the variations of ADSL are still under development. Although a number of ADSL modems were available for testing, it's not fair to say that they're in mass production. Because ADSL technology is too immature, we declined to name a Best Overall winner in this category. Instead, we present some test results of what we believe is a real-world scenario.

## ADSL Conundrum

**B**ecause the technologies that are used by ADSL modems are too different and are not interchangeable—and they have no formal standardized test suites—we declined to choose a Best Overall ADSL winner from among them. However, we did uncover some interesting data during our testing.

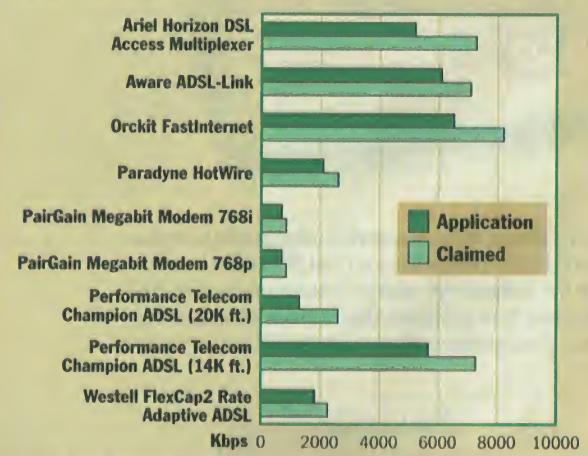
The distance between the modem and the central office plays a significant role in an xDSL modem throughput. The closer the modem is to the central office, less signal degradation occurs.

The good news is that manufacturers are being realistic about their claims of ultimate throughput. In well-tailored packet-blast tests over clean lines, we were able to prod each ADSL modem to almost its advertised maximum throughput speed.

Packet blasting produces high numbers, but it's hardly a realistic operating mode. We wanted a sense of how these modems would perform with real applications.

To imitate a typical application, a single client opened eight concurrent IP sessions over a clean line with a mixture of FTP and HTTP—simulating a typical Web-page access. The accompanying graph shows that the throughput results we measured compare well to the speed claims of the vendors.

### Clean Lines Deliver the Data



# WEB MASTERED

## Common Ground 4.0

**Power-publishing for the intranet.  
Fully automated, zero administration, instant results.**

Still struggling to Web-enable your business documents? Common Ground users just drag their documents to the dropbox, and they're done!

Common Ground prepares the documents for the Web, places them on the Web server and updates the HTML pages accordingly. And it does it all automatically!

The Java-powered viewer makes viewing documents easy too. Users don't have

to download a reader or open applications to see the document.

Download your evaluation copy now to see how Common Ground can deliver instant results for you!



**FREE EVALUATION:**

<http://www.hummingbird.com/cg/cgdownload.html>



[www.hummingbird.com/bm](http://www.hummingbird.com/bm) e-mail: [sales@hummingbird.com](mailto:sales@hummingbird.com) (416)496-2200

Circle 190 on Inquiry Card.

# We have won the industry's technology awards, now let's have fun making money!



## Suggestions for Scantastic:

Scantastic is our all-in-one TWAIN compatible software that will satisfy your every aspiration for cutting edge text and image processing technology. Use Scantastic to scan directly into e-mail, repair smudged faxes, match colors, and much more. But best of all is that new COLOR OCR function that eliminates time-consuming retying and makes desktop publishing unnecessary. Scantastic - Eleven of the hottest software programs on the market!



## Suggestions for FunScan:

FunScan consists of six user friendly imaging applications in one awesome value-added package. With FunScan you can make your own greeting cards, and T-Shirts, play puzzle games and design your own screensaver and Internet homepages. Using our state-of-the-art technology, your scanner is now intuitive and easy.

**SPOT**™

The Smart Player of Technology  
<http://www.spotinc.com>  
E-mail: [webmaster@spotinc.com](mailto:webmaster@spotinc.com)

SPOT USA/1-800-611-SPOT • SPOT UK/44-170-5322555 • SPOT Germany/49-2204-842950  
SPOT TECHNOLOGY INC. 886-3-5878966

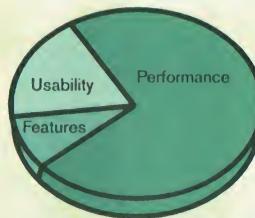
# LAB RATING RESULTS

## BEST OVERALL: 56-KBPS MODEMS x2 TECHNOLOGY

### U.S. Robotics Courier V. Everything V.34 (E)

Excellent performance and a high feature score more than compensated for below-average usability and propelled the U.S. Robotics Courier V. Everything V.34 external modem into first place among x2 modems. The U.S. Robotics Courier V. Everything V.34 internal modem finished close behind its external sibling.

#### WEIGHTING



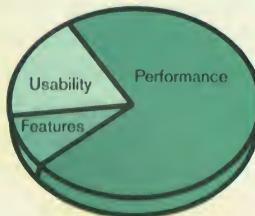
	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
<b>U.S. Robotics Courier V. Everything V.34 (E)</b>	\$275	★★★★★	★★★	★★★★★	★★★★★	★★	★★★★★
U.S. Robotics Courier V. Everything V.34 (I)	\$245	★★★★★	★★★	★★★★★	★★★★★	★★★	★★★★★
MaxTech GVC NetPacer Pro XPV551 (I)	\$149	★★★★★	★★	★★★★★	★★★	★★★	★★★★★
Logicode Quicktel 56P (I)	\$169.95	★★★★★	★★★	★★★	★★★	★★★★★	★★★★★
Cardinal Connecta (E)	\$199	★★★★★	★★	★★★★★	★★★	★★★	★★★★★
Archtek America SmartLink 5634BTV (I)	\$149.99	★★★★★	★★	★★★★★	★★★	★	★★★
Practical Peripherals PP Data/Fax (E)	\$239	★★★★★	★★	★★★	★★★	★★★	★★★
Zypcom Z34-SC (E)	\$179	★★★★★	★★★	★★★	★★★	★★★	★★★

## BEST OVERALL: 56-KBPS MODEMS K56FLEX TECHNOLOGY

### Zoom Telephonics 2849-PC (E)

Besting not only its K56flex companions, but the entire x2 field as well, the Zoom Telephonics 2849-PC external modem was our overall winner. Its top performance score was boosted by above-average usability and an adequate array of features. The internal version of the 2849-PC took fourth place, behind the two x2 Couriers.

#### WEIGHTING



	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
<b>Zoom Telephonics 2849-PC (E)</b>	\$199	★★★★★	★★★	★★★★★	★★★	★★★★★	★★★★★
Zoom Telephonics 2849-PC (I)	\$199	★★★★★	★★★	★★★★★	★★★	★★★★★	★★★★★
Diamond Multimedia Systems SupraExpress (I)	\$149.95	★★★★★	★★★	★★★★★	★★★	★★★	★★★★★
Practical Peripherals PP K56 Flex (I)	\$179	★★★★★	★★	★★★★★	★★★	★	★★★★★
Diamond Multimedia Systems SupraExpress (E)	\$169.95	★★★★★	★★★	★★★★★	★★★	★★★	★★★★★
Motorola ModemSurf (E)	\$179	★★★★★	★★	★★★★★	★★★	★★	★★★★★
Hayes Accura 56K (E)	\$189	★★★★★	★★	★★★★★	★★★	★★★	★★★★★
Motorola ModemSurf (I)	\$159	★★★★★	★★	★★★★★	★★★	★★	★★★★★
Boca Research BocaModem (E)	\$169	★★★★★	★★★	★★★	★★★★★	★★★	★★★
Apex Data Rapid Transit (I)	\$148	★★★★★	★	★★★	★★★	★	★★★

## BEST OVERALL: ISDN MODEMS

### 3Com Impact IQ

Although pricey, the \$399 3Com Impact IQ ISDN external modem combines the performance, features, and usability you'll want for your ISDN connection. Bargain hunters should consider the \$195 Arescom Flash 200, which turned in top performance at a rock-bottom price.

#### WEIGHTING



	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
<b>3Com Impact IQ</b>	\$399	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
ZyXel omni.net	\$299	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Motorola ISG BitSurf Pro EZ	\$285	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Boca Research Webglider	\$399	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
U.S. Robotics Courier I-Modem w/V.Everything	\$370	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Hayes Microcomputer Products Accura	\$279	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Arescom Flash 200	\$195	★★★★★	★★★	★★★★★	★★★★★	★★★★★	★★★★★

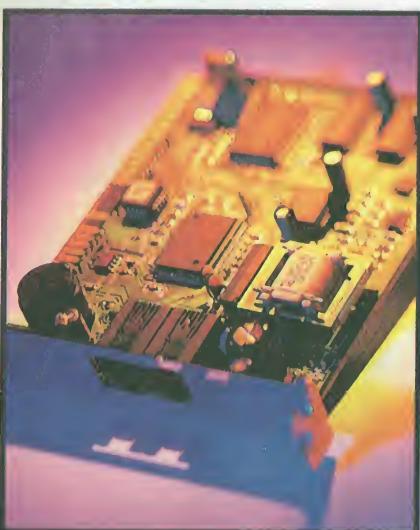
★★★★★ Outstanding    ★★★★ Very Good    ★★★ Good    ★★ Fair    ★ Poor

(I) = Internal    (E) = External

# DETAILS

## ISDN Inside

Logitech's internal ISDN modem connects to an ISA slot and is the only unit of the ISDN lot that connects internally.



## Small Lights, Big Documentation

Motorola's ISDN modem has a miserly six lights, and there's no power switch on it. However, it ships with a CD that includes copious documentation, good for set-up-intensive ISDN modems.

## Zoomin' Ahead of the Rest

The Zoom 2849-PC modem has the most interesting form factor of all the 56-Kbps modems we looked at. It's little, 5.25 inches wide and 6.5 inches long. It sports 14 indicator lights, one of which tells you when you're transmitting at 33.6 Kbps; another alerts you when you reach 56 Kbps. A message light, used by some software packages, lights up when a fax is waiting.



## TECH FOCUS

## 56-Kbps MODEMS

### 56-Kbps Reality Check

When the news broke that 33.6 Kbps was the end of the line for Public Switched Telephone Network (PSTN) modems, we had no reason to doubt it. Perhaps that's why we were so enraptured with the debut of new technologies that could increase data transfer speeds to the previously unimaginable 56-Kbps level. Now, with more than a dozen 56-Kbps offerings and two distinctive technologies on the market, it's time to pause for a 56-Kbps reality check.

By now, everyone knows that designating these modems as 56-Kbps devices is somewhat dishonest. Their ultimate speed is currently limited to 53.3 Kbps by FCC dictate. Even when operating at their theoretical maximum, 56-Kbps technology is asymmetrical. You can hope for 53.3-Kbps downloads, but you're still limited to a maximum of V.34 upload speeds.

For example, only the best local lines can support the demands of 56-Kbps operation. Poor-quality local loops generally result in download speeds in the low 40-Kbps range.

Another bottleneck that's often overlooked may be inside your system: your antiquated serial port. If you're using a standard 16550 universal asynchro-

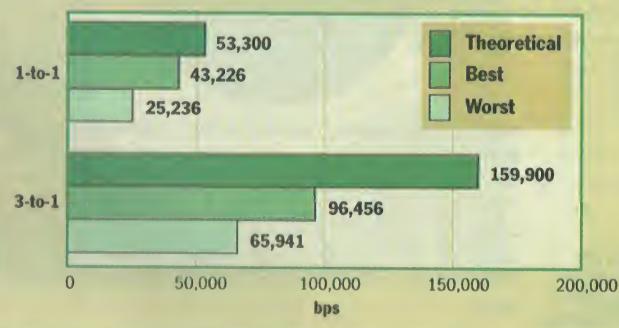
nous receiver/transmitter (UART) and an external modem, you're limiting your baud rate to 115.2 Kbps—regardless of the capability of your modem. Add in data compression of over 2-to-1, and you've saturated your serial port.

Fortunately, a number of high-speed serial-port products are available to address this problem. When required during our testing, we used the Digi AceelePort 4r-PCI DB25, from Digi International, to provide access of up to 230 Kbps. Lava Computer claims that its LavaPort-PnP port can support a baud rate as high as 460 Kbps.

The accompanying graph compares a 56-Kbps modem's theoretical data throughput to the best and worst data rates delivered by the modems we tested. In the first test, we used an incompressible file that ideally should have delivered a full 53.3 Kbps over clean lines. Instead, the slowest modem reached just 47 percent of that goal, and the fastest just over 81 percent.

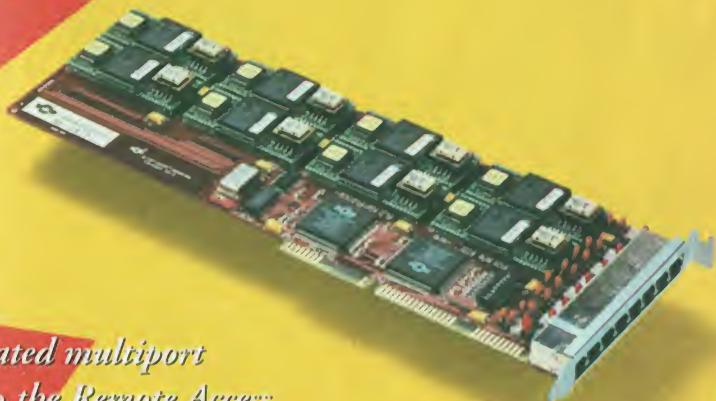
Next, we switched to a file that was designed to support 3-to-1 compression under V.42bis. Our worst and best results were 41 percent and 60 percent of theoretical capacity, respectively. In both cases, we used a high-speed serial port good for transfer rates of up to 230 Kbps.

### 56 Kbps: Reality vs. Expectation



# When it comes to fast Remote Access, nothing beats a Rocket.

*Turn your LAN  
into a launch pad  
with RocketModem  
from Comtrol. It's  
the fastest way to break  
the Remote Access barrier.*



*RocketModem is an integrated multiport modem card that speeds up the Remote Access process. Combining Comtrol's RocketPort ISA-bus multiport controller with either 4 or 8 board-mounted, industry-standard 33.6 Kbps fax modems, RocketModem eliminates multiple component complications. You get easier installation with less wiring and clutter around the server. Our industry-leading serial controller technology is built right on-board, resulting in minimal CPU utilization without sacrificing data throughput. The net result: more savings for you.*

*Get Remote Access in a hurry. Call Comtrol today.*

**ROCKET MODEM**  
MULTIPORT MODEMS

From

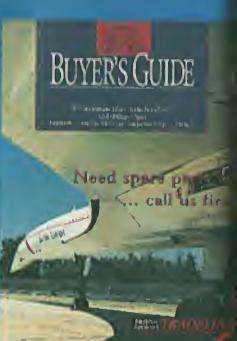
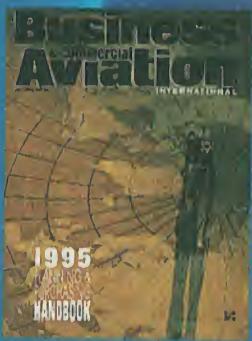
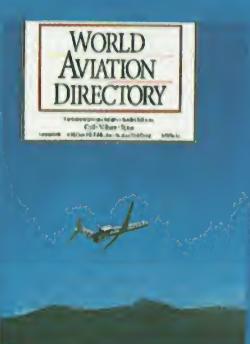
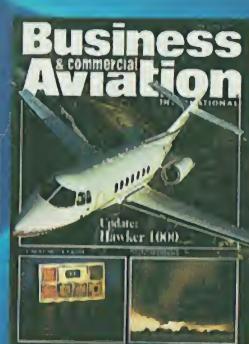
**COMTROL**  
INNOVATION IN REMOTE ACCESS

900 Long Lake Road, St. Paul, MN 55112  
Tel: 800 926-6876 Fax: 612 631-8117  
<http://www.comtrol.com/us/BYT>  
E-mail: [info@comtrol.com](mailto:info@comtrol.com)

© 1997 Comtrol Corporation. ALL RIGHTS RESERVED. All other brand names and product names are trademarks or registered trademarks of their respective holders.

# WHERE THE AEROSPACE

# The Aviation Week Group: Print for every professional in global



# WORLD TURNS FIRST

and electronic products  
aviation and aerospace



Aviation Week Group publications and electronic products comprise the most extensive family of leading information services in the global aviation and aerospace industry. Every publication is the leader in its market.

Whatever your professional affiliation with aerospace, you'll find magazines, newsletters, directories, conferences and electronic media ready-made to serve your specific information needs. Information when you want it, in the format of your choice.

If you are an advertiser, you'll find the Aviation Week Group has the media to match your markets. Civil, Military, Space — Technology, Business, Operations.

Aviation Week Group: 1 million+ readers  
140+ countries

CONTACT US TODAY FOR MORE INFORMATION.  
SUBSCRIPTIONS  
TEL: 1-800-257-9402  
FAX: 609-426-7087  
(OUTSIDE U.S. CALL 609-426-5526)

ADVERTISING  
TEL: 212-512-3084  
FAX: 212-512-4225

**AVIATION WEEK GROUP**

# TEST RESULTS

**T**he three types of modems we evaluated—56-Kbps, ISDN, and ADSL—use specific technologies to solve different problems. We rated ISDN and 56-Kbps modems based on their performance, features, and usability (on a scale of 1–5 stars). In the ADSL arena, we didn't choose a winner because we feel the technology is too immature at this point.

## The 56-Kbps Methodology

We evaluated 56-Kbps modem performance in terms of data compression and throughput. We tested over clean lines as well as over lines with various impairments. Because 56-Kbps modems rely on two competing and incompatible chip sets—K56flex and x2—we assembled two test-beds tailored to each technology. Before testing, we configured each modem to use hardware-based compression and the maximum connection rate supported by the modem's driver.

During a test session, we recorded the



**TAS Series II telephone network emulator and Model 240 loop emulator from Telecom Analysis Systems.**

time required to download three files, each about 300 KB, and used the result to determine the Kbps throughput rate. The three files we used support a maximum compressibility of 1-to-1, 3-to-1, and 5-to-1, respectively. A serial port supporting baud rates of up to 230 Kbps was used for external modems.

Simulating a typical central-office connection was the TAS Series II telephone network emulator and Model 240 loop emulator. To exercise the specific modems, we used the Total Control system from U.S. Robotics for testing x2 products, and the Max 4000 from Ascend for testing K56flex products.

To measure throughput under impaired conditions, we used the eight line conditions recommended by TAS for 56-Kbps modem testing; these conditions are currently in draft status before the Telecommunications Industries Association (TIA). The impairments represent various combinations of five factors: analog and digital pad loss,

robbed-bit signaling, transhybrid loss, and delay. In addition, all lines (including the clean line used for comparison) were subject to the quantization noise, which normally occurs because of the analog/digital conversion involved with 56-Kbps modems.

The overall score for 56-Kbps modems comes from a 70:20:10 weighted rating of performance, usability, and features, respectively (see the pie chart on page 80C). We judged a modem's performance based on raw throughput on both clean and impaired lines. The better a modem's ability to compress data and deliver it at high speed, the higher its score.

## The "x" in xDSL

*Accompanying the emerging Digital Subscriber Line (DSL) technology is a veritable alphabet soup of new acronyms.*

**N**ew DSL modems are faster than 56-Kbps modems and hold several potential advantages over ISDN. ISDN requires a special telephone line in your home or business, while DSL uses existing telephone wiring. The ISDN data rate of up to 128 Kbps looks good until you compare it to a DSL capacity of 8 Mbps!

All vendors agree that DSL is a transmission scheme designed for high-speed data networking over existing copper telephone wiring. Beyond that, however, it's a wide-open frontier of methodology, implementation, and acronyms. The term xDSL is used to represent a wide variation of DSL technologies. Here's a quick guide to the most common terms you'll encounter.

**H**igh-Bit-Rate Digital Subscriber Line (HDSL) has been around the longest. It provides full-duplex T1 (1.544-Mbps) or E1 (2.048-Mbps) data transmission across existing twisted-pair copper without repeaters. By

using the existing copper infrastructure, you can implement HDSL systems quickly.

**S**ymmetric Digital Subscriber Line (SDSL) provides symmetric bidirectional variable-rate communications and voice on a single phone line. It transmits data at 160 Kbps to 2084 Mbps. This technology is suitable for applications that require a symmetric data rate.

**A**symmetric Digital Subscriber Line (ADSL) provides three separate channels over the same phone line. The asymmetry is based on an approximate 10-to-1 ratio in the downstream-to-upstream data rates—appropriate for high-speed Internet or multimedia access. Phone conversations are carried on one channel, downstream data from the service provider to the user is transferred on another line, and upstream data from the user to the service provider runs in the third channel.

**V**ery High-Bit-Rate Digital Subscriber Line (VDSL) simply means your data rate can increase because you're closer to the central office. Data rates of 13 Mbps at 5000 feet from the central office, 26 Mbps at 3000 feet, and 51 Mbps at 1000 feet are possible.

## ISDN Face-Off

For ISDN testing, our server had a high-speed serial port. A Teletone ISDN Simulator connected the server to the client PC. A high-speed serial port was also supplied on the client side to accommodate the modem being tested.

As with the 56-Kbps modems, the time required to download the three 300-KB test files was recorded to determine the Kbps for each connection. The three files used supported a maximum compressibility of 1-to-1, 3-to-1, and 5-to-1, respectively. Several runs were performed on each file type and used to produce an aggregate score.

*Evaluations in this report represent the judgment of BYTE editors, based on tests conducted by NSTL, Inc., as documented in a recent issue of its monthly PC Digest. To purchase a copy of the full report, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428; 610-941-9600; fax 610-941-9950; on the Internet, editors@nsl.com. For a subscription, call 800-257-9402. BYTE magazine and NSTL are both operating units of The McGraw-Hill Companies, Inc.*

# ISDN REMOTE ADAPTERS FEATURES

	Arescom	Boca Research, Inc.	Hayes Microcomputer Products, Inc.	Motorola ISG	3Com	U.S. Robotics	ZyXel
Models	Flash 200	Webglider	Hayes Accura	BitSurf Pro EZ	3Com Impact IQ	USR Courier I-Modem w/ V.Everything	omni.net
Price as tested	\$195	\$399	\$279	\$285	\$399	\$370	\$299
Overall rating	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
<b>LINE INTERFACE</b>							
ISDN	U (1)	U (1)	U (1)	U (1)	U (1)	U (1)	U (1)
Analog phone jacks	2	2	2	2	2	1	2
Interface to computer	ISA slot	Serial port	Serial port	Serial port	Serial port	Serial port	Serial port
<b>PROTOCOL SUPPORT</b>							
V.120	✓	✓	✓	✓	✓	✓	✓
V.110			✓	✓	✓	✓	✓
Asynchronous/synchronous PPP	✓	✓	✓	✓	✓	✓	✓
Multilink PPP	✓	✓	✓	✓	✓	✓	✓
Other			BOD	AIMUX			
<b>DATA COMPRESSION</b>							
Compression	✓	✓	✓	✓	✓	✓	✓
Maximum throughput speed	512-Kbps	230-Kbps	460-Kbps	512-Kbps	230-Kbps	512-Kbps	460-Kbps
Analog-modem-compatible	✓	✓	✓	✓	✓	✓ (integrated 56-Kbps modem)	✓
<b>TELCO SWITCH STANDARDS</b>							
National ISDN-1, ISDN-2	✓	✓	✓	✓	✓	✓	✓
AT&T 5ESS	✓	✓	✓	✓	✓	✓	✓
Northern Telecom DMS-100	✓	✓	✓	✓	✓	✓	✓
<b>DATA TRANSMISSION RATES</b>							
Rate without compression	128-Kbps	128-Kbps	128-Kbps	128-Kbps	128-Kbps	128-Kbps	128-Kbps
Other	56, 64-, 112-Kbps	64-Kbps and below			64-Kbps	19.2-, 28.8-, 33.6-, 56-Kbps	56-Kbps, 64-Kbps
<b>FUNCTIONALITY</b>							
Software-upgradable	✓	✓	✓		✓	✓	✓
Fax capabilities	✓		✓	✓	✓	✓	✓
Simultaneous voice and data	✓	✓	✓	✓	✓	✓	✓
Simultaneous analog calls	✓	✓	✓	✓	✓	✓	✓
Security	PAP/CHAP authentication	Caller ID, call screening/filtering, call logging	Caller ID, IETF handshake authorization	Caller ID	PAP/CHAP authentication, IETF, caller ID	PAP/CHAP authentication	✓
Number of status LEDs	N/A	7	9	6	8	13	10
SIZE (inches)							
Internal or external device	Internal	External	External	External	External	External	External
Width	N/A	5.9	7.0	6.4	5.4	6.3	17.9
Depth	N/A	7.9	5.2	5.3	8.6	10.3	13.1
Height	N/A	1.5	1.5	1.5	1.5	1.3	3.8
Weight	N/A	1.1 lbs.	12.4 oz.	10.5 oz.	1.2 lbs.	4.5 lbs.	13 oz.
<b>CUSTOMER SUPPORT</b>							
Warranty length (years)	3	5	2	5	5	5	2
Fax	510-445-3636	561-997-0918	770-449-0087	205-430-8926	847-933-5800	847-933-5800	714-693-8811
Phone	510-445-3638	561-997-6227	770-441-1617	205-430-8000	See Web site	847-982-5010	714-693-0808
Toll-free phone	None	800-583-2622	800-429-3739	800-894-4736	800-877-2677	800-572-3266	800-255-4101
Web address	http://www.arescom.com	http://www.boca-research.com	http://www.hayes.com	http://www.mot.com/ISDN/3com.com	http://www.usr.com	http://www.zyxel.com	
Inquiry number	1020	1021	1022	1023	1024	1025	1026

**B** = BYTE Best

✓ = yes;  
N/A = not applicable.

★★★★★ Outstanding  
★★ Fair

★★★★ Very Good  
★ Poor

★★ Good

# HIGH-SPEED MODEMS FEATURES

	Apex Data Div., Smart Modular Technologies	Archtek America Corp.	Boca Research, Inc.	Cardinal Technologies, Inc.	Diamond Multimedia Systems	Diamond Multimedia Systems, Inc.	Hayes Microcomputer Products, Inc.	Logicode Technology, Inc.
Model	Apex Data Rapid Transit Internal Modem	SmartLink 5634BTV Internal Voice/Fax/Modem	BocaModem/External	Connecta External Fax Modem	SupraExpress External Modem	SupraExpress Internal Modem	Accura 56K External Fax Modem, 08-02887	Quicktel 56P Internal Modem
Price as tested (MSRP)	\$148	\$149.99	\$169	\$199	\$169.95	\$149.95	\$189	\$169.95
Overall rating	★★	★★★	★★★	★★★★	★★★★	★★★★	★★★★	★★★★
<b>MAXIMUM RATE (Kbps)</b>								
DDE data/DCE fax/DTE	56/14.4/115.2	56/14.4/115.2	56/N/A/230.4	61.3/14.4/115.2	56/14.4/230.4	56/14.4/230.4	56/14.4/115.2	56/14.4/115.2
<b>COMMAND SETS</b>								
Hayes	✓	✓	✓	✓	✓	✓	✓	
Ties								
Break					✓	✓		✓
<b>GENERAL-PURPOSE FEATURES</b>								
Modem technology	K56flex	×2	K56flex	×2	K56flex	K56flex	K56flex	×2
Chip set and DSP	Lucent	TI	Rockwell	TI	Rockwell	Rockwell	Rockwell	TI
Data pump	N/A	TI	Rockwell	N/A	Rockwell	Rockwell	Rockwell	TI
Caller ID	✓	✓	✓					✓
Paging			✓					
Voice over data (DSVD)	✓		✓					
Voice compression		✓	✓					
DTMF		✓	✓	✓				
Flash EPROM	✓		✓	✓	✓	✓	✓	
Flash BIOS			✓	✓	✓	✓	✓	
Adaptive speed leveling (ASL)		✓	✓	✓	✓	✓	✓	
Volume-control slide			✓	✓	✓	✓	✓	
<b>BACKBONE FEATURES</b>								
Auto-baud all speeds		✓	✓	✓	✓	✓	✓	
Select speeds		✓	✓	✓	✓	✓	✓	
Blacklisting			✓					
Callback security								
Carrier-loss redial								
Dictionary sizing						✓	✓	
Remote configuration/password								
Synchronous communication								
X.25 pad								
Software	Bitware Data/Fax/Voice V.3.30	QuickLink Message Ctr. 3.0	Quicklink Message Ctr. 3.0, Netscape Navigator, Boca Mega-Media CD	FaxTalk Plus V3.0a	FaxTalk Plus 3.0, COMit	FaxTalk Plus 3.0, COMit	Smartcom Message Ctr. 2.0G3	QuickLink II Version 2.1.0
<b>COMMON STANDARDS</b>								
Group III fax		✓						
MNP error control	5	5	5 and 10	5	5	5	5	5
V.42	✓	✓	✓	✓	✓	✓	✓	✓
V.fast			✓		✓			
Non-ITU standard		✓			✓	✓		
HST								
Bell 103J and 212A	✓	✓		✓	✓	✓		
Additional features	Full-duplex speakerphone and voice-mail features	Full-duplex speakerphone features					Auto-data/Fax discrimination	✓
<b>CUSTOMER SUPPORT</b>								
Warranty length (years)/coverage	5/P,L,R	5/P,L,R	5/P,L,R	5/P,L	5/P,L,R	5/P,L,R	2/P,L,R	Lifetime
Toll-free phone	800-841-2739	None	800-583-2622	800-947-0808	800-727-8772	800-727-8772	800-347-8388	800-735-6442
Phone	510-623-1231	818-912-9800	561-997-9657	770-840-2157	408-325-7000	408-325-7000	770-840-9966	805-388-9000
Web address	www.apexdata.com	http://www.archtek.com	www.boca-research.com	www.cardtech.com	http://www.diamondmm.com	http://www.diamondmm.com	www.hayes.com	www.logicode.com
Inquiry number	1027	1028	1029	1030	1031	1032	1033	1034



✓ = yes;  
N/A = not applicable.

**Warranty:** P = parts; L = labor;  
F = freight to repair center; R = return to customer.

★★★★★ Outstanding  
★★ Fair

★★★★ Very Good  
★★ Poor

★★★ Good

MaxTech Corp.	Motorola ISG	Motorola ISG	Practical Peripherals	Practical Peripherals	U.S. Robotics	U.S. Robotics	Zoom Telephonics, Inc.	Zoom Telephonics, Inc.	Zypcom, Inc.
GVC NetPacer Pro XPVS561 Internal Modem \$149 ★★★★★	ModemSurfr Internal Data/Fax Modem \$159 ★★★★★	ModemSurfr External Data/Fax Modem \$179 ★★★★★	PPK56 Flex Internal Half Card Modem \$179 ★★★★★	PP Data/Fax External Modem \$239 ★★★★★	USR Courier V.Everything V.34 External Modem \$275 ★★★★★	USR Courier V.Everything V.34 Internal Modem \$245 ★★★★★	Zoom 2849-PC External Fax Modem \$199 ★★★★★	Zoom 2849-PC Internal Fax Modem \$199 ★★★★★	Zypcom Z34-SC External Modem \$179 ★★★★★
56/14.4/115.2	56/28.8/115.2	56/28.8/230.4	56/14.4/115.2	61.3/14.4/115.2	56/14.4/230.4	56/14.4/230.4	56/14.4/230.4	56/14.4/230.4	56/14.4/115.2
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
x2 TI TI ✓ ✓	K56flex Rockwell Rockwell ✓	K56flex Rockwell Rockwell ✓	K56flex Rockwell Rockwell N/A	x2 TI TI ✓	x2 TI TI ✓	x2 TI TI ✓	K56flex Rockwell Rockwell	K56flex Rockwell Rockwell	x2 Cirrus Logic Cirrus Logic ✓ ✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓/✓					✓/✓	✓/✓	✓	✓	✓/✓
✓					✓	✓			
SuperVoice 2.2	Trio communications software	Trio communications software	Practical Message Center V1.33	Practical Message Center V1.031	Stampede Remote Office Gold Client, RapidComm	Stampede Remote Office Gold Client, RapidComm	Winfax Lite, DOSfax Lite, COMit, AOL, CompuServe	Winfax Lite, DOSfax Lite, COMit, AOL, CompuServe	V5.30
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	5	5	5	5	5	5	5 and 10	5 and 10	5
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓/✓	✓/✓	✓/✓	✓/✓	✓/✓	✓/✓	✓	✓	✓
Data compression/voice and speakerphone functions	V.80-ready voice functions	V.80-ready voice functions			Universal connect, automatic fax/data detection	Universal connect, automatic fax/data detection			Voice and speakerphone functions
5/P,L None 562-921-1698 http://www.maxcorp.com/html/pvps56 1035	5/P,L,R 800-426-6336 205-430-8000 http://www.mot.com/modems/ 1036	5/P,L,R 800-426-6336 205-430-8000 http://www.mot.com/modems/ 1037	3/P,L 800-225-4774 770-840-9966 www.practinet.com 1038	1/P,L 800-225-4774 770-840-9966 www.practinet.com 1039	5/P,L,F,R 800-877-2677 847-982-5010 www.usr.com 1040	5/P,L,F,R 800-877-2677 847-982-5010 www.usr.com 1041	7/P,L 800-631-3116 617-423-1072 www.zoomtel.com/k56/56k.html 1042	7/P,L 800-631-3116 617-423-1072 www.zoomtel.com/k56/56k.html 1043	2/P,L,R None 510-783-2501 www.zypcom.com 1044

# Powerful and Effective Network Licensing

WIBU-KEY presents a new type of network licensing.

It's simple to set up and use. It makes license administration easier on your customers. And it's based on the time-proven WIBU-KEY technology that's been used by thousands of developers around the world since 1989.

WIBU-KEY is the only network licensing system that provides complete, cross-platform licensing backed by true application encryption for the highest degree of security and functionality.

**WIBU-KEY –**  
There is a difference



- ✓ Limits concurrent usage to the level you specify
- ✓ Cross-platform support for heterogeneous networks
- ✓ Protection based on application encryption for complete security
- ✓ Ready for the future: License limits can be updated in the field at no extra charge
- ✓ License software in multiple ways to create new markets for your applications
- ✓ The first and only ISO 9000 Certified system.

**Call now for your free Test Kit: (800) 986 6578**  
**Providing the Highest Quality Copy Protection.**  
**Since 1989**



Germany and International:  
**WIBU-SYSTEMS AG**  
 Rueppurrer Strasse 54 · D-76137 Karlsruhe  
 Tel. +49-721-93172-0 · FAX +49-721-93172-22  
 email: info@wibu.de · http://www.wibu.de



North and South America:  
**Griffin Technologies, LLC**  
 1617 St. Andrews Drive, Lawrence, KS 66047  
 Tel. (785) 832-2070 · FAX (785) 832-8787  
 email: sales@griftech.com · www.griftech.com

Argentina: **Grupo Consultor S.A.** · Tel. +54-1-3744711 · Fax +54-1-3728115 · info@grupocsa.com.ar · Belgium, Lux.: **COMPUSEC** · Tel. +32-2-6450944 · Fax +32-2-6464266 · info@compusec.be · Brasil: **CASATK** · Tel. +55-47-444-0859  
 Fax +55-47-444-0859 · casatk@netville.com.br · Croatia: **ARIES d.o.o.** · Tel. +385-1-222752 · Fax +385-1-2326535 · Denmark: **DANBIT A/S** · Tel. +45-53662020 · Fax +45-53662030 · cahe@danbit.dk · Estonia: **LanSoft Ltd.** · Tel. +372-2-212-2120 · Fax +372-2-212-2120 · lansoft@infonet.ee · France: **NEOL S.A.** · Tel. +33-3-88623752 · Fax +33-3-88333772 · NEOL@compuseve.com · Japan: **SUNCARLA Corporation** · Tel. +81-3-3249-3421 · Fax +81-3-3249-3444 · fwid9705@mb.infoweb.ne.jp · Netherlands: **COMPUSEC** · Tel. +31-53-5740223 · Fax +31-53-5726822 · info@compusec.be · Spain/Portugal: **DUBIT** · Tel. +351-1-7971008 · Fax +351-1-7971013 · www.dubit.pt

See us at:  
**COMDEX**  
 Fall '97 S 704  
**SYSTEMS 97**  
 Hall 9 · Booth A15

**INFORMATION SYSTEMS PROFESSIONALS**

WITH GROWTH AS RAPID AS OURS, WHY TAKE ANY OTHER ROUTE THAN  
**AMERICA'S INTERSTATE OF INFORMATION SYSTEMS** FOR THE MOST ADVANCED IS OPPORTUNITIES.

**Notes • Tivoli • C •**  
**C++ • Data Warehousing**  
**Relational Database Design & Administration**  
**UNIX Programming & Administration**  
**Windows NT Applications & Network Development**  
**Network Programming, Administration, Design**  
**Object Oriented Database Design**  
**Sybase • Oracle**  
**Informix**  
**Microsoft SQL**

Clinical Implementation Specialists •  
 Business Systems Analysts • Multimedia  
 Developers • Data Warehouse and  
 Decision • Support Developers • User  
 Support Representatives • Application  
 Administrators • Decision Support  
 Specialists • Database Administrators  
 System Administrators •  
 Telecommunications Specialists •  
 Network Administrators • System  
 Operators • Application Developers •  
 Software Developers • Network  
 Developers • Platform Integrators •  
 Project Managers • Financial Analysts

If interested send resume including  
 Job Code 344C to: **Vencor, Inc.**,  
 c/o Recruitment Solutions,  
 743 E. Broadway #410,  
 Louisville, KY 40202.

Phone: 888-Route-IS Fax: 800-773-4599  
 e-mail: vencor@recruitmentsolutions.com  
 www.vencor.com EOE

**Vencor**  
 America's Long-Term Healthcare Network

**ROUTE I/S**  
 Please visit our booth at the Career Expo.



**J**ava is like a child prodigy who can play a Rachmaninoff piano concerto but still isn't potty-trained. The flashes of brilliance and glimpses of future potential are marred by cranky behavior that's typical of a two-year-old.

It's hard to overlook Java's immaturity. Compared to native code, interpreted Java byte code is as slow as a line at the post office. Java development tools are diamonds in the rough—sometimes very rough. Despite the "write once, run anywhere" mantra, there are still nagging differences among Java virtual machines (VMs) that cause Java programs to misbehave on different platforms. Java's API for

# JAVA GETS DOWN TO BUSINESS

*Critics say Java isn't ready for prime time. But others are using it to solve real-world business problems. What's their secret?*

**By Tom R. Halfhill**

creating GUIs, the Abstract Window Toolkit (AWT), is such a mess it seems everyone is rewriting it. And Sun Microsystems is wrestling with Microsoft over Java's future.

In other words, it's a lot like the chaotic early days of Windows, the Macintosh, and MS-DOS. But few people remember the Stone Age APIs of Windows 1.0, or that Mac developers had to clumsily compile their first programs on a Lisa, or that Microsoft once wrestled with Digital Research over the future of DOS. When any new platform is born, pessimists focus on the flaws while optimists hype the potential. Caught between are developers, who need to solve real-world problems today. When will Java be ready for prime time?

It's ready right now, according to some developers who are currently using Java to do some surprisingly serious

business, as outlined below.

■ A Silicon Valley start-up company built an enterprise-wide purchasing application that eliminates paper-pushing, runs across multiple client platforms, links outside vendors to corporate intranets, and integrates with enterprise databases.

■ A Washington-based consulting firm rewrote an employment-practices expert system that it originally developed in C/C++.

■ An independent consultant in California is using Java to reengineer the employee-review process at a major biotech company.

■ A systems integrator in New Jersey is using Java applets and middleware to provide a help-desk service to corporate customers.

■ A businessman who can't write a single line of Java code used a tool that automatically converts Excel spreadsheets into Java applets.

■ Sony Online Ventures created a high-traffic commercial Web site with server-side Java components that dynamically generate most of the Web pages.

■ Home Shopping Network is using server-side Java software to run a large-scale Web site that hosts on-line auctions and connects to a product database.

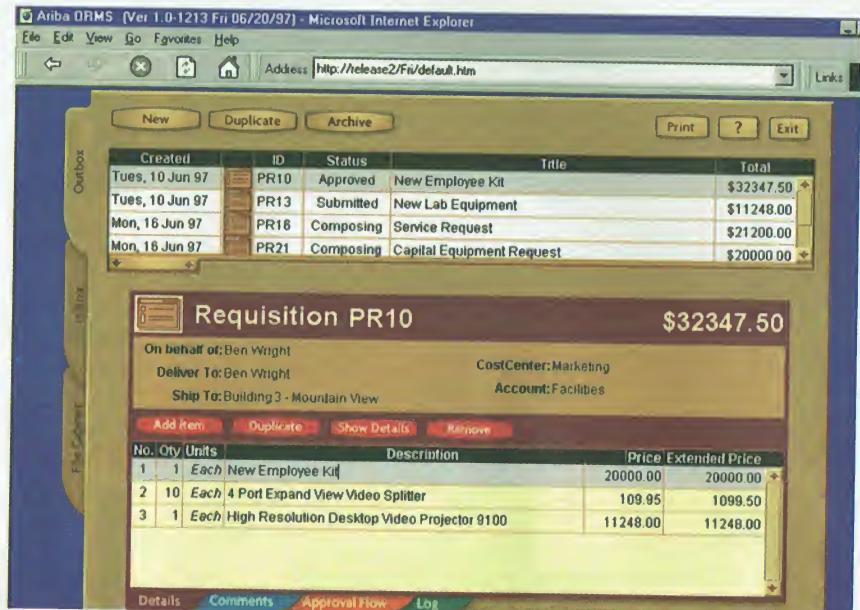
■ A major defense contractor is using a Java-based indexing-and-retrieval engine to create a parts inventory that engineers can search from a browser on any client.

These are not isolated cases. An independent survey of BYTE readers last May found that 54 percent are developing Java software. In another study commissioned by the Java Internet Business Expo, analysts at Zona Research surveyed 279 IT professionals at organizations that have 250 or more computers. They discovered that 47 percent are using Java today, while the rest expect to use it within the next 12 months. Of the companies that have already adopted Java, 52 percent are rolling out finished applications.

"The average portion of application-development budgets for Java endeavors will rise from 12 percent during the next six months to over 21 percent within the next 24 months," concludes chief analyst Clay Ryder from Zona's study. "Java is more than a passing fad."

## Java Trends

For this article, BYTE concentrated on business applications that are either finished or in the early stages of deployment. We



**Ariba ORMS uses server- and client-side Java software to automate the corporate-purchasing process.**

found that four trends emerged.

■ Developers are completing some of their projects in a matter of months, despite Java's flaws. Coders praise Java's advantages over C/C++ as an object-oriented language, and they're confident that development will get smoother as the tools keep getting better.

■ A great deal of Java development is hidden from view because it's for in-house use by corporations. At this point, few developers are using Java to write shrink-wrapped commercial applications.

■ Java programs that execute on servers are at least as significant as Java applets that run in browsers—even though applets are what most people associate with Java. Again, this tends to make Java development less visible than it really is. Some large-scale Web sites and enterprise applications depend heavily on server-side Java, but they use few or no Java applets.

■ The main reason developers are selecting Java over other solutions is cross-platform compatibility. In other words, they are embracing Java as a platform, not just as a language. Zona reached the same conclusion, finding that Java's abilities to work with Web browsers and on different platforms are by far the biggest reasons enterprises have for adopting Java.

These trends make sense. Large organizations tend to accumulate many different platforms, and they're not in a hurry to replace perfectly good equipment. But

this causes problems while deploying applications throughout the enterprise. The only common denominators are networks and browsers. Java allows developers to pave over the differences between platforms and quickly distribute networked solutions to any number of clients.

## Putting Java to Work

Platform neutrality is why start-up Ariba Technologies picked Java for its new Operating Resource Management System (ORMS). Ariba ORMS automates the purchase of equipment, office supplies, furniture, vehicles, and almost anything else that isn't directly required for a company's product manufacturing. Those miscellaneous purchases typically account for 22 percent of corporate costs. It's a business process that screams for automation, because the cost of handling paper forms can exceed the cost of a requisitioned item.

It's also a process that's widely distributed and has to work with existing clients and legacy systems. Nobody wants to discard thousands of usable desktop PCs or replace their mainframes just to accommodate one new application. "If you go into a Fortune 1000 company, they've got AS/400s, they've got Hewlett-Packard systems, they've got Unix, they've got mainframes," says Paul Touw, marketing and business-development manager for Ariba. "That almost defaults you to Java."

Ariba ORMS extends its reach even be-

## Excelling at Java

Some of the latest Java tools make it possible to deliver cross-platform solutions to millions of Web or intranet users without writing a single line of code. Michael Kranitz, director of digital business at The Computer Group, recently used such a tool to convert a commercial application into a Java applet.

The original product, LeaseWizard, is written in Borland Delphi for Windows. It helps car shoppers decide whether leasing or purchasing is a better deal. Kranitz wanted to post a free, abbreviated version of LeaseWizard on his Web site, but he doesn't know how to program in Java. So, he constructed a working prototype in Excel and used a tool called SmartTable, by Visual Numerics, to automatically convert the spreadsheet into a Java applet. SmartTable creates Java class files that duplicate both the appearance and the function of the spreadsheet. Users can enter data and calculate results on-line.

Later, Kranitz hired a programmer to write an HTML/JavaScript version that non-Java browsers can use. However, it doesn't do as much interactive error-checking when users enter data, and it consumes a lot more screen space. "You have to scroll it, and that's a big deal," says Kranitz. "[The Java applet] looks a lot better on the screen."

Netscape - [LeaseWizard Jr. Pop Up Calculator]

Enter General Information:		Enter Loan Information:	
MSRP	\$19,250	Origination Fee	\$50.00
Dealer's Best Offer	\$18,000	Down Payment	\$2,500.00
Net Trade In (- or +)	\$0	Term (months)	36
Sales Tax Rate %	5.75	Ann. Percentage Rate %	9.125
Enter Lease Information:		Enter Personal Factors:	
Acquisition Fee	\$200	If I had extra money, I would likely:	Spend it!
Cap Cost Reduction	\$3,000	My marginal tax rate is:	21%
Term (months)	36	LeaseWizard Jr. Comments:	
Money Factor (.00???)	0.00375	The loan input appears plausible.	
Residual Value	\$10,780	The loan input appears plausible.	
Percent of MSRP %	56	Compare	
Method of Taxation	Stream	Lease	vs.
Payment with Sales Tx	\$238.30	\$528.46	
Total Up Front Costs*	\$3,478.30	\$2,500.00	
Gross Cost of Vehicle	\$11,578.91	\$21,524.40	
Credit for Cash Advances	\$0.00	\$0.00	

LeaseWizard Jr. is an Excel spreadsheet converted into a fully functional Java applet.

beyond the enterprise. Outside vendors can distill their offerings into spreadsheets that contain prices, product options, stock numbers, and just about anything else—even hyperlinks that point to the vendor's own Web site, which might have data sheets and illustrations. Ariba imports the vendors' spreadsheets into an on-line catalog that users can browse with a Java applet.

The password-protected applet is the front end for the purchasing process. It provides a graphical interface and step-by-step instructions. It also enforces customizable business rules that govern how a company routes and approves purchases.

On the back end, Ariba's server-side Java application acts as the middleman between the applets and the company's legacy systems. It talks to databases via Web-Logic's JdbcKona, which is a collection of

Java Database Connectivity (JDBC) drivers for Oracle, Sybase, and Microsoft SQL Server. On Windows NT servers, Ariba also links to Crystal Reports.

Remarkably, Ariba's customers began deploying an early version only seven months after Ariba started the project in December 1996. "There's no way we could have built a C++ program in seven months that does everything our Java server does," claims Ariba engineer Boris Putanec.

Not that everything went smoothly; Ariba encountered many problems. A bug in Microsoft's early just-in-time (JIT) compiler caused IF statements to execute incorrectly. Java's thread synchronization was not consistent—Windows NT spawns native threads to handle Java threads, while Sun's Solaris piggybacks all Java threads on one native thread. Java's FI-

NALLY statement can kill a thread that throws an exception. And Ariba's programmers struggled with differences in Java VMs on various platforms. Putanec says wryly, "Instead of 'write once, run anywhere,' it's more like 'write once, debug everywhere.'"

Nevertheless, they got it working. To overcome deficiencies in the AWT, Ariba turned to Netscape's Internet Foundation Classes (IFC), a class library that offers more graphical flexibility and a consistent look and feel across platforms.

Two of Ariba's pilot customers are AMD and Cisco Systems, both based in Silicon Valley. AMD began installing ORMS in June and expected to have it in full production by late August. AMD plans to eventually deploy ORMS on as many as 4000 desktops. Cisco also began implementing ORMS during the summer and expects to deploy it on 8000 to 10,000 desktops around November. Both companies say that ORMS meshes well with existing clients and back-end systems.

"We're doing this for solid business reasons, not just to geek out on the technology," says Pat Guerra, AMD's vice president of supply management. He explains that by automating the paper-driven purchasing process, ORMS is freeing his employees for more productive duties. They are already being retrained to measure the performance of suppliers more accurately and to negotiate better deals.

Guerra says that he selected a Java solution because AMD has everything from Windows PCs and Unix workstations to IBM mainframes and DEC VAX minicomputers. Some of the legacy systems are 15 years old. "Cross-platform compatibility is a huge factor," he explains. "That makes the application support much easier and less costly than a platform-specific solution."

At Cisco, employees use Windows PCs, Unix systems, and Macs, and they're scattered at field offices all over the world. Cisco needed a multiplatform, multilanguage, multicurrency solution that integrated with Oracle Purchasing. Ariba ORMS does all that, and it also generates purchase orders in the ANSI-standard EDI-850 electronic-data-interchange format for vendors that accept them.

Cisco program manager Carolyn DePalmo says the project is on schedule and that she's looking forward to distributing ORMS worldwide. "It's obviously difficult for people in satellite offices to deal with

paper forms. This way, they can just shoot their requisitions over the Web," she says.

## Selling to the Feds

Another developer sold on cross-platform compatibility is Washington Consulting Services & Technologies (WCS&T), which recently ported a C/C++ client/server application to Java. The application, called Chinook, is an employee-relations expert system for government agencies and corporations.

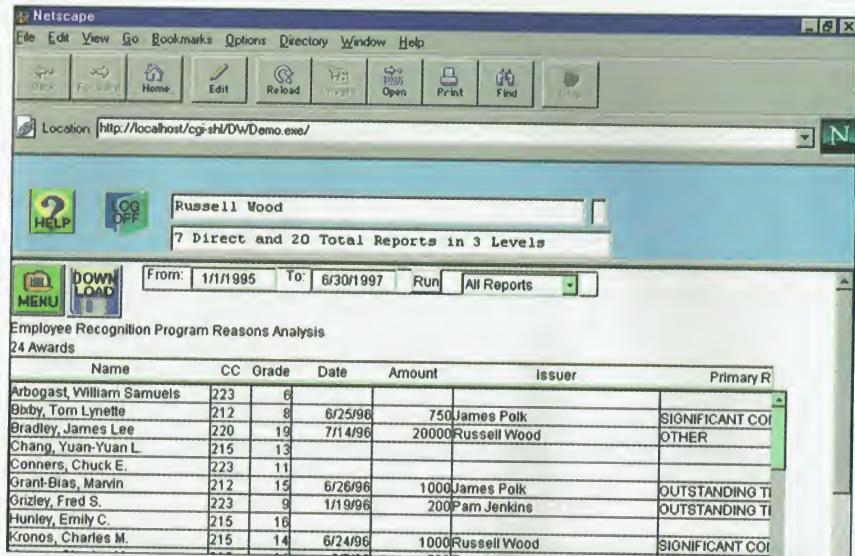
Chinook helps to guide managers through sticky situations that can have costly consequences—employee absenteeism, substance abuse, sexual harassment, discrimination, and so forth. Chinook's decision-logic tables are based on case law, court settlements, company policies, and best practices at other organizations. After asking a manager a series of questions, Chinook generates a risk-analysis report and suggests actions. Those actions might range from writing a letter or a memo—complete with recommended wordings—to specific forms of discipline.

"It's not 'attorney-in-a-can'; it's not a legal advisory tool," says Linda Brooks Rix, president of WCS&T. "But it does help managers deal with these problems. It also helps to level an organization so managers are more consistent in their actions and discipline."

Rix says the C/C++ version of Chinook is used by organizations with as many as 250,000 employees and 40,000 managers. When the software needed a major rewrite, the company decided to convert it to Java so the front end would run on any client. The National Science Foundation is about 50/50 Mac/Windows, she points out, and Macs are also popular at NASA and the U.S. Air Force. "The federal government is very interested in intranet solutions because they're less expensive than standardizing on a single platform," Rix explains.

WCS&T began rewriting Chinook in April. The task was made easier by the fact that the programmers had written the C/C++ version with a rules-based component framework and development suite called Elements, from Neuron Data. When Neuron recently ported the suite to Java, it added a utility that translates C/C++ resource files into Java classes. That slashed the amount of code the programmers had to rewrite, says Gary Frank, director of software development at WCS&T.

They did encounter some problems—mostly due to limitations in Java 1.0.2,



**CRC built a custom Java applet that allows all 700 middle managers at a major biotech company to access employee records.**

Frank says, Applets under 1.0.2 can't talk to printers or save files on the client, so the server-side program has to generate the reports in HTML and display them in a printable browser window. "It was more of an annoyance than anything else," he says. WCS&T finished the Java port in July and immediately began working with customers to test and deploy the product.

## Biofeedback

Another consultant is using cross-platform Java to solve an unusual problem for a 3200-employee biotech company in California. The company stores employee records in a 10-year-old database that runs on Novell NetWare and MS-DOS. The database does an adequate job and is heavily customized, so the company isn't eager to replace it. But to implement a new employee-review process aimed at reducing attrition, the company needed to expand access from about a dozen people to all 700 middle managers. The existing database simply couldn't handle it.

"They could not access this data. It was basically locked up. It was a classic data-warehouse problem," says Chris Christian, principal of CRC Business Solutions, the consultant hired to find a solution.

To complicate the challenge, the biotech company's managers use many different clients—mostly Macs, but also Windows PCs and Unix workstations. All of them need access to the database, and the company didn't want to install any new client software or browser-specific plug-ins. Also,

some of their browsers don't run Java.

Fortunately, an intranet was already in place, running under Unix on a Digital Alpha server. The same server replicates the DOS database to Oracle 7 every night. So, Christian built his first solution with Prolifics JamWeb, a client/server engine that fetches information from the Oracle database and launches a CGI process to generate HTML pages for the browsers.

Unfortunately, the HTML pages tend to be large and can't display much information on the screen. Christian used a new Java version of Prolifics (3.0) to display the data more compactly in an applet with a scrolling grid widget. The user interface is more consistent on different-size screens, and the applet downloads faster. The Prolifics engine uses a special form-description language to automatically generate HTML and JavaScript for browsers that don't run Java, so Christian didn't have to create multiple versions of his client-side application.

To complete the project, Christian had to tap skills in Java, JavaScript, HTML, SQL, the Prolifics form tool, and even graphics design. "It's not programming as we used to know it," he says. "Developers need a lot of different skill sets. And because the application is running inside a browser, everyone expects it to look like a graphically exciting Web page."

## Leveraging the Web

Because the Web amounts to a global WAN, developers are using it to build extranets

Opportunity Management - 25

File Edit Forms Spreadsheets Tools Options Help

Opportunity ID: 25  Source Code: 600S6

Description: Sale for 1 week consulting

Main Contact Contact List

Contact ID: 1  Stage: Quote Submitted

First Name: Greg

Last Name: Lewis

Phone: (508)899-1000 Ext: 789

Forecast Team Opportunity Details

Forecast Date: 10/31/95

Forecast Value: 3000.0000

Probability(%): 100%

PO received

Factored Value: \$150000

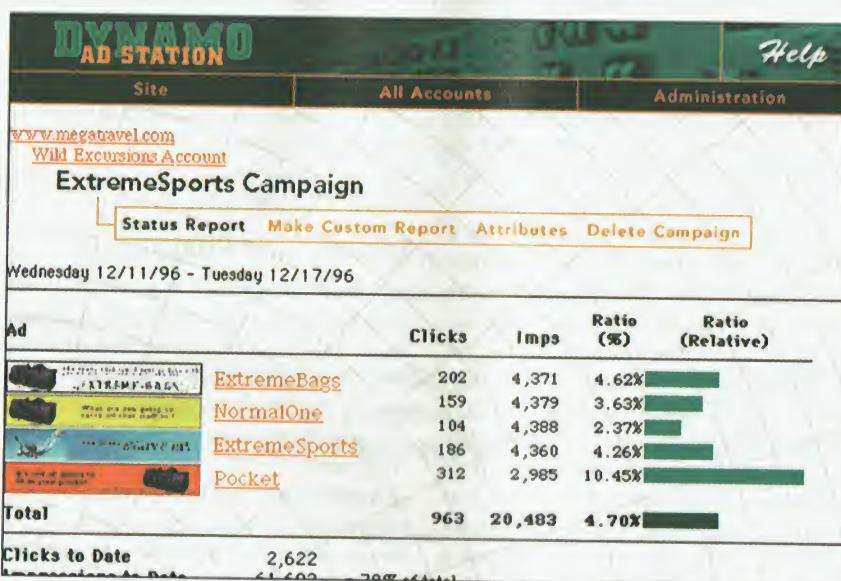
Account Products Diary Actions Quotes Sale Lost

Account ID: 1  Locations:

Account: Northern Data Systems Corp.

Territory: MA

Applix Anyware is a suite of Java applets that connects users to back-end databases.



Dynamo Ad Station makes it easier for Webmasters to manage the advertising on their Web sites.

between companies as well as intranets between platforms. The links between Ariba ORMS and outside vendors are one example; another is a help-desk application implemented by LANcomp, a 50-employee systems integrator and reseller in the New York area.

LANcomp is delivering a 24-hour help desk to its customers through a suite of Java applets called Applix Anyware. The applets allow customers to notify LAN-

comp's technicians about problems and then track the progress of solutions. Both parties also have 24-hour access to LANcomp's knowledge base, which is stored in an Oracle database. The middleware is Applix Enterprise, a native server-side component. The knowledge base contains documentation, solutions to common problems, illustrative screen photos, and hyperlinks to useful Web sites.

"We needed the ubiquitous access of a

Web-enabled product that our employees and customers could use from any location or from any client," explains Dan DeVenio, LANcomp's vice president for sales and marketing. "All you need is a Java-enabled browser and a password."

The cross-platform applet is as important to LANcomp internally as it is to outside customers, adds Bob Rudis, technical operations manager. LANcomp's employees use an eclectic mix of Windows PCs, Unix systems, and network computers (NCs) from Sun and HDS. The alternative would have been to write, deploy, and maintain multiple versions of the help-desk program on all of LANcomp's systems as well as those of its customers—a Herculean task that, ironically, would generate help-desk calls of its own.

## Server-Side Java

There are thousands of Java applets on the Web, but server-side Java gets less attention because it's generally invisible to users. Some Webmasters (including BYTE's Jon Udell) think Java can be more useful on servers than on clients, at least in the short term.

It's a compelling argument. Server-based programs conserve bandwidth and don't require users to have Java-enabled browsers because they don't download or execute any Java on the client. They're free to use the latest and best Java VMs because they don't have to wait for browsers to catch up. They can boost the performance of critical routines by calling native methods, because server programs usually don't have to run across multiple platforms. And Java's lightweight threads can handle multiple HTTP connections with fewer CPU resources than traditional CGI processes.

All those factors convinced Sony Online Ventures to use server-side Java components to build SonyStation, a family-oriented commercial Web site. With 150,000 to 200,000 users per day, it's one of the busiest Java-powered sites on the Web.

SonyStation users can register for services and navigate the site with a Java applet called the StationPass, but that's just the tip of the iceberg. A suite of server programs known as Dynamo does the bulk of the work. Dynamo, from Art Technology Group (ATG), consists of three integrated Java applications: Ad Station, which manages on-line advertising; Profile Station, which keeps track of user demographics; and Retail Station, which manages electronic commerce. They dynamically

generate about 75 percent of SonyStation's Web pages. On the back end, Dynamo uses WebLogic JDBC drivers to plug into Sony's SQL database.

ATG says Dynamo is a testament to Java's strengths as a programming language. The coders started with an earlier version written in C++, completely rewrote it in Java, and shipped the product only five months later. Most of the code—some 200,000 lines—took just two months to write. And the programmers did it in early 1996, when Java tools were primitive. In fact, they didn't use any Java tools to speak of: They typed the code into EMACS, a text editor, and compiled it with Sun's free Java Development Kit (JDK). They've since adopted Symantec Café.

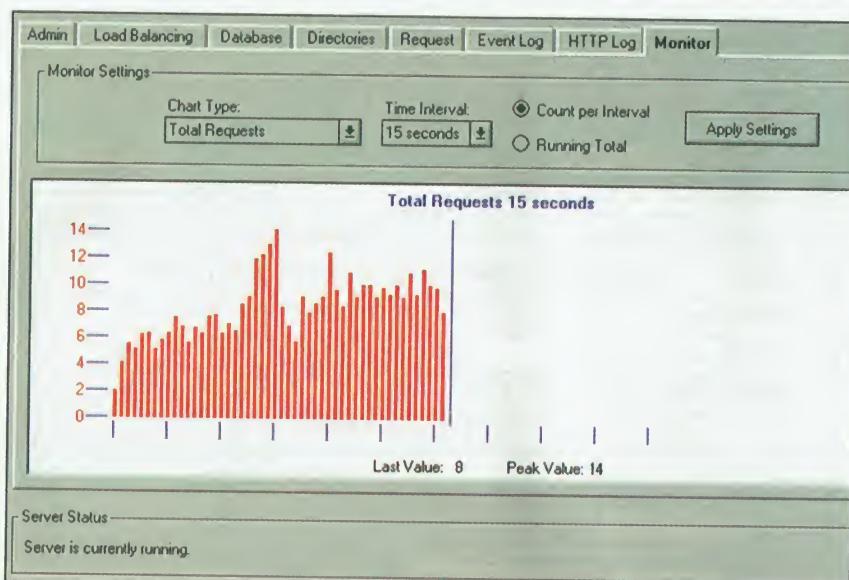
"It was pretty scary when we made the leap to Java," says Jeet Singh, president and CEO of ATG. "We were scared that the uptake on Java wouldn't be as fast as it was. We thought Sun was pitching the wrong things about Java, like animation on Web pages. Nobody was talking about server-side Java at all, and we were trying to build this huge server-side app."

The Java version of Dynamo was easier to write and is easier to maintain than the C++ version, Singh declares, partly because it simplifies multithreading and memory management. Also, it's certified to run on multiple-server platforms: Windows NT (both x86 and Alpha), Solaris, and Irix—or any platform with a compatible Java VM. Singh says the difference in performance between the C++ and Java versions is not significant.

Sony is satisfied with the performance, according to Mark Benerofe, vice president of programming for Sony Online Ventures. Benerofe also likes ATG's open server APIs, which allow Sony's developers to write new applications that access Dynamo's services with only a few lines of code. For example, developers can create on-line games that check the site's list of registered users through Dynamo's gateway to the SQL database. Another API call might return the player's profile, which a game could use to adjust its difficulty level or to display a targeted ad banner.

Not everything worked perfectly at first. "We had a whole host of bugs when we first rolled out because we were on the cutting edge and nobody had ever done a Java site on this scale," admits Benerofe. He says Sony and ATG soon resolved the problems.

Another high-traffic Web site built with



### Kiva Enterprise Server is a middle-tier component that links Web servers to enterprise databases.

server-side Java is First Auction, owned by Home Shopping Network. First Auction users can view data about products and enter competitive bids on-line; winners get to buy the products at their bids. The site went public in June and racked up \$100,000 in sales in the first three days, says Keith Foxe, communications manager.

First Auction runs on a Solaris system with Kiva Enterprise Server, a middle-tier Java component that sits between the Web-server software and an enterprise database. Developers can use Kiva's Java class libraries to write applets or applications that talk back to the server via IIOP (using a third-party object request broker [ORB] from Iona or Visigenics) or Kiva's own communications protocol (based on sockets). The classes are transport-independent, so developers could also use a third-party bridge to DCOM.

Kiva wrote the core services in C/C++ because some of the early Java VMs for Unix weren't multithreaded, but all the application-level services are Java classes. The classes let developers distribute application logic between the client and the server, according to performance and security requirements. For instance, an applet can check the validity of a credit-card number without bothering the server.

Like other Java middleware components, Kiva allows developers to create Web applications that work with existing enterprise systems. First Auction uses Kiva to link its Web server to an Oracle data-

base. "Not many companies are saying they want to write all-new applications from scratch in Java," says Sharmila Shahani, Kiva Software's director of product marketing. "But many companies do want to leverage their existing investment while also taking advantage of new opportunities by migrating to the Web."

### Server-Side Portability

Java programs on servers generally don't need the run-anywhere mobility of applets because they live in a controlled environment. Nevertheless, some developers are writing distributed applications that run across heterogeneous servers as well as heterogeneous clients.

A prime example is Innotech's NetResults, a text-indexing and text-retrieval application that lets users find documents anywhere on a network. The server-side pieces consist of an indexer, a search engine, and an administration tool. The client-side component is an applet that allows users to make queries and view sorted results. NetResults was among the first applications to win 100 percent Pure Java certification from Sun.

"Intranets don't often consist of roomfuls of Windows NT servers," explains Simon Arnison, Innotech's vice president for R&D. "We find that many companies have strange combinations of servers running everything from NT, to Linux on Macs, to AIX on PowerPC, to Solaris on SPARC. We wanted to support all those

# Another HiProf User.



**W**hen you use **HiProf 2.0** to analyze your program, you'll find that you can identify bottlenecks and problem spots in your code more quickly and easily than ever before, leaving you time to do, well, *whatever*.

HiProf provides clear insight into the structure and performance characteristics of your app, and lets you:

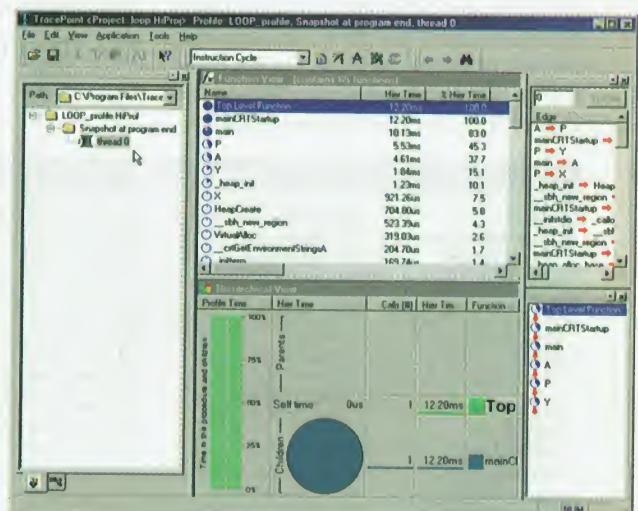
- see time spent in parent functions and their children as well as all the calls taking place between them
- analyze your finished binary files in just minutes (no OBJ files or source code required)
- selectively exclude DLLs or portions of your EXE from analysis
- identify and view your app's critical performance path
- watch the stack in real time to sort out resource conflicts

**So try out HiProf today.  
See you on the slopes —  
or wherever — tomorrow.**

From TracePoint, of course.  
Performance tools for software developers.

**For more information or a FREE trial version, visit our web site at  
[www.tracepoint.com](http://www.tracepoint.com) or call us at  
888-688-2504**

HiProf 2.0 for Visual C++ - \$249 (estimated street price)  
HiProf 2.0 for Visual Basic - \$199 (estimated street price)



HiProf 2.0 for C++ works on Win32 applications developed using Microsoft Visual C++ 2.X, 4.X, and 5.0.  
HiProf 2.0 for Visual Basic works on apps created with Visual Basic 5.0.

**TracePoint**

**HiProf**

Circle 136 on Inquiry Card.

TracePoint: A DIGITAL Company

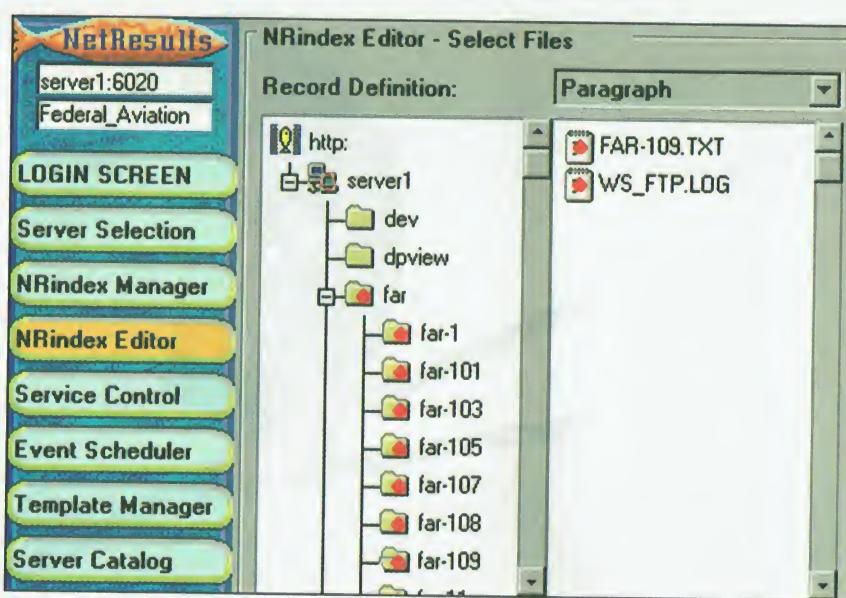
**digital**™

platforms with a single product, without the problems that other companies face by having to create multiple versions for all those platforms."

Java seems like an odd choice for an application that needs high performance. The first version of NetResults was only about a tenth as fast as native code. The latest version is about one-fourth as fast. When compiled with a JIT compiler, it's about one-third as fast. Arnison thinks the performance is sufficient and that the advantages are worth the trade-off. He's confident that future improvements—including Java chips—will eventually banish the performance issue.

Like other Java pioneers (the project began in November 1995), Innotech hit a number of snags. NetResults shipped six months late because of problems with unstable Java VMs, incomplete APIs, and crude tools. For instance, Innotech had to write all its own sort routines because they're missing from JDK 1.0.2. And Innotech doesn't make any loose "run anywhere" claims until after it has tested the code on a slew of platforms: Windows, Power Mac, NetWare, SCO Unix on x86, an SGI workstation, and two different flavors of NCs (a Sun JavaStation and an HDS@WorkStation).

Still, NetResults shipped months ahead of most other Java products, and it's welcomed by those who need a cross-platform solution. Anton Ritter, a consultant for Computer Sciences, is installing it on servers at a major defense contractor. Engineers can use it to rapidly locate data about thousands of complex parts in the company's inventory, even from NCs on the factory floor. A related Java project allows



Innotech's NetResults can index and retrieve files across multiple-server platforms.

engineers to display an image of a part on-screen, and a future version will render the part in Virtual Reality Modeling Language (VRML) so engineers can manipulate and view the image from any angle.

"Our main requirement is that it must be multiplatform," explains Ritter. He encountered a few pitfalls along the way—he had to compile the programs with Sun's JDK 1.1 because of problems with JDK 1.0.2—but nothing insurmountable. He's convinced that Web- and intranet-based solutions are the wave of the future.

### The Next COBOL

There's still a lot of things that developers can't do with Java. They can't write

applications that compete feature-for-feature with leading products, such as Microsoft Office. They can't write programs that demand outstanding performance. They can't write multimedia extravaganzas. And they can't deploy large-size applets that ooze through slow networks like cold syrup.

Of course, before embarking on any project, it's a developer's responsibility to determine whether the tools at hand are up to the task. It's not easy to make that determination with Java because its capabilities keep changing from month to month.

Despite its shortcomings, Java is already making such significant inroads into the enterprise that its future as a programming language for business applications is virtually assured. In a positive sense, Java is becoming the next COBOL—literally, a common business-oriented language.

Unlike COBOL, Java is also a platform. Java could fail in that role while still succeeding as a language. But its ability to deliver cross-platform networked solutions is the biggest reason businesses are adopting Java, and that bodes well for its survival. It's looking more and more likely that Java will be the most successful new platform to take root since Windows made its debut in 1985. ■

*Tom R. Halfhill is a BYTE senior editor based in San Mateo, California. You can reach him at [thalfhill@bix.com](mailto:thalfhill@bix.com).*

### WHERE TO FIND

Applix Westborough, MA 508-870-0300 <a href="http://www.applix.com/">http://www.applix.com/</a>	Computer Sciences El Segundo, CA 310-615-0311 <a href="http://www.csc.com">http://www.csc.com</a>	Kiva Software Mountain View, CA 650-526-3900 <a href="http://www.kivasoft.com/">http://www.kivasoft.com/</a>	<a href="http://station.sony.com/">http://station.sony.com/</a>
Ariba Technologies Mountain View, CA 650-237-3800 <a href="http://www.ariba.com/">http://www.ariba.com/</a>	CRC Business Solutions Oakland, CA 510-569-2721 <a href="http://www.dnai.com/~crc">http://www.dnai.com/~crc</a>	LANcomp Piscataway, NJ 908-981-1991 <a href="http://www.lancomp.com/">http://www.lancomp.com/</a>	<a href="http://www.vni.com/">http://www.vni.com/</a>
Art Technology Group Boston, MA 617-859-1212 <a href="http://www.atg.com/">http://www.atg.com/</a>	First Auction (Home Shopping Network) <a href="http://www.firstauction.com/">http://www.firstauction.com/</a>	Neuron Data Mountain View, CA 650-528-3450 <a href="http://www.neurondata.com/">http://www.neurondata.com/</a>	Washington Consulting Services & Technologies Tacoma, WA 253-984-7933 <a href="http://www.west.com/">http://www.west.com/</a>
The Computer Group Columbus, OH 614-876-8600 <a href="http://www.leasesource.com/">http://www.leasesource.com/</a>	Innotech Multimedia North York, Ontario 416-492-3838 <a href="http://www.innoteched.com/">http://www.innoteched.com/</a>	Prolifics New York, NY 212-267-7722 <a href="http://www.prolifics.com/">http://www.prolifics.com/</a>	WebLogic San Francisco, CA 415-659-2600 <a href="http://www.weblogic.com/">http://www.weblogic.com/</a>
	SonyStation (Sony Online Ventures) <a href="http://www.zonaresearch.com/">http://www.zonaresearch.com/</a>	Zona Research Redwood City, CA 650-568-5700 <a href="http://www.zonaresearch.com/">http://www.zonaresearch.com/</a>	

# CORBA, Java, and the Object Web

*The Web is in trouble. CORBA and Java are out to save it.*

By Robert Orfali, Dan Harkey, and Jeri Edwards

**T**he next-generation Web—in its Internet, intranet, and extranet incarnations—must be able to deal with the complex requirements of multistep business-to-business and consumer-to-business transactions. To do this, the Web must evolve into a full-blown client/server medium that can run your line-of-business applications. The current HTTP/CGI paradigm is flawed; it can't meet these new requirements. The various CGI extensions—such as cookies, the Microsoft Internet Services API (ISAPI), the Netscape Server API (NSAPI), Active Server pages—are simply Band-Aids. To move to the next step, the Web needs distributed objects. We call this next wave of Internet innovation the "Object Web."

One approach to creating the Object Web is with Common Object Request Broker Architecture (CORBA) and Java. Without the Object Web, CORBA and Java would just be esoteric technologies—mostly of interest to the enterprise client/server market and to object aficionados. As it turns out, CORBA and Java are having a shotgun wedding. Their marriage must be consummated for the higher good of the Object Web. The anxious parents are a coalition of vendors that includes almost everyone in the software industry but Microsoft. Microsoft is building its own Object Web, based on its ActiveX/Distributed Component Object Model (DCOM) technology. This may explain the sense of urgency behind the CORBA/Java wedding. We'll first do the introductions and then tell you all about the CORBA/Java Object Web.

First, we must warn Java supporters that CORBA is a lot more than just an object request broker (ORB)—it is also a very complete distributed object platform. CORBA extends the reach of

your Java applications across networks, languages, component boundaries, and operating systems.

Next we must warn CORBA proponents that Java is much more than just another language with CORBA bindings. Java is a mobile object system; it is a portable OS for running objects. Java will allow your CORBA objects to run on everything from mainframes to network computers to cellular phones. Java simplifies code distribution in large CORBA systems: Its bytecodes let you ship object behavior around, which opens exciting new possibilities for CORBA mobile agents. We find Java to almost be the ideal language for writing our client and server CORBA objects. Its built-in multithreading, garbage collection, and error management make it easier to write robust networked objects.

The bottom line is that these two object infrastructures complement each other well. Java starts where CORBA leaves off. CORBA deals with network transparency, while Java deals with implementation transparency. CORBA provides the missing link between the Java portable application environment and the world of intergalactic objects.

## So Why the Shotgun?

So why isn't this marriage made in heaven? Until recently, the problem was one of establishing clean divisions between the work of the Object Management Group (OMG, the force behind CORBA) and JavaSoft. For example, JavaSoft started to get into the ORB business when it defined its remote method invocation (RMI) for Java-to-Java communications across virtual machines. It really stepped squarely on OMG's toes with that one—the 700-plus members of the OMG gave it the mission to develop distributed object standards.

*continued*



The good news is that this turf war appears to be over. JavaSoft adopted CORBA as its distributed object model; it will run the RMI APIs on top of CORBA/Internet Interoperable ORB Protocol (IIOP) with help from the OMG. This June announcement has done a lot to help heal the rift between the CORBA and Java camps. Here's how JavaSoft plans to make CORBA part of the Java core:

Java Development Kit 1.2 (slated for Q3 '97) will include a pure-Java CORBA ORB. The ORB is a subset of Joe—the all-Java ORB included with Sun's NEO. In addition, JDK 1.2 will support JavaIDL, a development environment for generating CORBA stubs and skeletons from IDL. JDK 1.2 will also include an all-Java version of the CORBA Naming Service.

Java RMI will be implemented on top of CORBA/IIOP. This means that JavaSoft will abandon the proprietary ORB on which RMI is currently built.

A future JDK will support Enterprise JavaBeans. Enterprise Beans will communicate with client Beans via CORBA/IIOP (and other protocols). Most important, Enterprise JavaBeans will support the Java Transaction Service (JTS), which is based on the CORBA Object Transaction Service (OTS).

These announcements are very significant for both the low-end and the high-end of the CORBA/Java market. At the low end, you will be able to get from your JDK provider (perhaps even from Microsoft) a free CORBA/Java ORB as well as an IDL development environment. At the high end, you will be able to get transactional JavaBeans. Transactions provide ACID—atomic, consistent, isolated, durable—protection for Beans. They also serve as glue that you can use to synchronize independently developed Beans. Because of all this, what started as a shotgun wedding may be turning into a love affair.

What exactly is a CORBA/Java ORB? It's a CORBA/IIOP ORB that's written entirely in Java for portability. The ORB must be able to generate Java language bindings from CORBA IDL. In addition, any code generated by the IDL compiler must be in pure Java; you should be able to download that code and run it on any machine hosting a Java run-time environment.

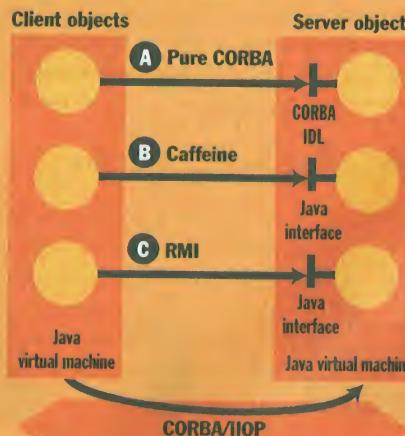
So where can you get one of these fabulous CORBA/Java ORBs? As we go to press, we know of three ORBs that fit the bill: Sun's Joe, Iona's OrbixWeb, and Visigenic/Netscape's VisiBroker for Java.

## Look Ma, No IDL

Today, our world is multilingual. But we hope the day will come when we can write all our code in pure Java—on the client and server. If you are one of the lucky ones who can do this today, you should consider using Caffeine, a tool from Netscape/Visigenic that lets you generate CORBA stubs and skeletons directly from Java interfaces.

The Caffeine development process starts with a Java interface that you declare to be remote by extending it—either directly or indirectly—from CORBA.Object. You must compile your interfaces using javac and then run the output through Java2IIOP—a bytecode post-processor that generates the CORBA stubs and skeletons. With Caffeine, a Java programmer never has to look at the CORBA interface definition language (IDL). The Java remote method invocation (RMI) uses a process similar to Caffeine to define remote interfaces. As parts of the great marriage, Caffeine and RMI may soon adopt the same APIs as well as a common approach for generating CORBA stubs and skeletons from within Java.

### Skeletons in Java's Closet



These are the three main Java-to-Java ORB-based communication options.

Each of these ORBs has strong backers. Joe will be incorporated in JDK 1.2 (you can download the beta). OrbixWeb is sold by Iona, the leading ORB vendor. And VisiBroker for Java is bundled in every Netscape Communicator and Enterprise Server; it is also being bundled with Oracle's Network Computing Architecture (NCA), Sybase's Jaguar, and Novell's IntranetWare. In addition to these pure-Java ORBs, many ORBs written in C++ now provide Java language bindings—for example, Expersoft's PowerBroker, IBM's Component Broker, and soon BEA's ObjectBroker.

## Why Today's Web Can't Hack It

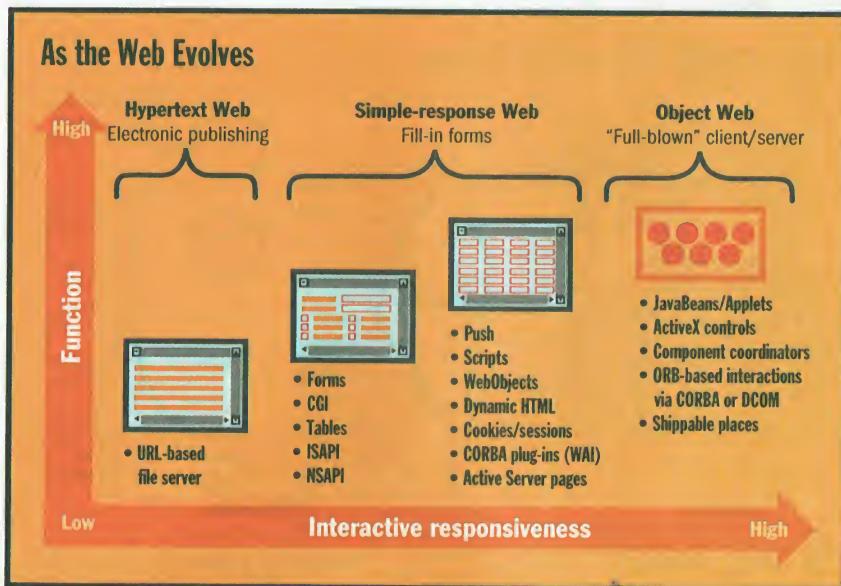
The Web first started out as a giant unidirectional medium for publishing and broadcasting static electronic documents. Basically, it was a giant URL-based file server. In late 1995, the Web evolved into a more interactive medium with the intro-

duction of three-tier client/server, CGI-style. CGI is now used to access every known server environment.

HTTP with CGI is a slow, cumbersome, and stateless protocol; it is not suitable for writing modern client/server applications. CGI is not a good match for object-oriented Java clients. Web server vendors have gone through numerous contortions to work around the limitations of HTTP/CGI. Their solutions are usually in the form of proprietary server extensions and new APIs such as NSAPI, ISAPI, Next's WebObjects, and WinCGI.

To get around HTTP's statelessness, some of these extensions may require that clients pass cookies (i.e., server data held on the client) to identify their state. Others extend cookies with session objects on the server to represent their clients. These attempts are mostly proprietary and seriously flawed.

In addition, CGI is slow; it launches a new process to service each incoming



### The Web is moving from file services to full-blown client/server applications.

client request. To get around this limitation, many of the vendor extensions provide memory-resident work-arounds—such as in-process DLLs, server plug-ins, and even ORB-based objects. In general, the server side will do almost anything to keep the services in memory across invocations. Consequently, it introduces another slew of nonstandard (and sometimes platform-specific) extensions.

The main problem with these approaches is that they require HTTP and the Web server to mediate between objects running on the client and on the server. There is no way for a client object to directly invoke a server object. The HTTP form you submit is still the basic unit of client/server interaction. This clumsy work-around is not suitable for full-blown client/server applications that require

highly interactive conversations between components. It also does not scale well.

In 1996, the Web finally discovered objects. Java applets were the first step toward creating a client/server Object Web. Java is a necessary but not sufficient step toward creating the Object Web; Java needs to be complemented with a distributed object infrastructure, which is where CORBA comes into the picture.

The Object Web was officially born in June 1997 when Netscape shipped Communicator with a CORBA/Java ORB. On the server side, Netscape shipped both a CORBA/C++ and CORBA/Java ORB with every copy of the Enterprise Server 3.0. The intersection of Java and CORBA object technologies is the first step in the evolution of the Object Web.

### Client/Server Interactions on the Object Web

How a Web-based client interacts with its server on the Object Web is pretty simple:

1. Web browser downloads HTML page. In this case, the page includes references to embedded Java applets.
2. Web browser retrieves Java applet from HTTP server. The HTTP server retrieves the applet and downloads it to the browser in the form of bytecodes.
3. Web browser loads applet. The applet is first run through the Java runtime security gauntlet and then loaded

## Meet the Object Web Players

A new coalition is building around the CORBA/Java Object Web. The Web transforms CORBA/Java from a set of standards to a set of products that fulfills an intergalactic need. To use a shopping mall analogy, the anchor stores of the CORBA Object Web are Netscape, Oracle, JavaSoft, and IBM/Lotus. This mall is also populated with hundreds of software vendors that provide the boutiques and specialty stores—including specialized object request brokers (ORBs), tools, components, and services. There should be enough critical mass to attract the shoppers with the dollars: independent software vendors, IT shops, and consumers of software.

Netscape is making CORBA ubiquitous on the client. It is bundling the VisiBroker for Java ORB with every browser. Netscape is also using CORBA for its server-to-server infrastructure. Potentially, Netscape can distribute over 40 million CORBA ORBs on the client and over a million CORBA ORBs on the server. CORBA also allows Netscape servers to play with other servers in the enterprise.

Oracle has adopted CORBA as the platform for its Network Computing Architecture. Oracle's entire software line, from the database engines to stored procedures, tools, and the Internet, will be built on a CORBA object bus. For example, the database engine will be componentized using CORBA. Third parties will be able to extend the database using CORBA components called Cartridges. Oracle is build-

ing most of the CORBA Services on top of the Visigenic IIOP ORB. This ORB will first appear in the next release of Oracle Web Server; it will serve as the foundation for Oracle's Internet products.

JavaSoft is making CORBA the foundation for distributed Java. SunSoft is building its Internet server strategy around CORBA using its NEO ORB and Solstice.

IBM/Lotus is building its cross-platform network computing infrastructure on CORBA/Java. IBM intends to bundle a Java run-time with all its OS platforms. The IBM VisualAge tool will target CORBA/Java objects on both clients and servers across all the IBM platforms. The IBM Component Broker is a scalable server-side component coordinator for managing middle-tier CORBA/Java objects. Finally, the next Lotus Domino is being built on an IIOP foundation.

The boutiques include veteran CORBA players like Apple, HP, SunSoft, IONA, Digital, Novell, and Experisoft. This camp also includes ODBMS vendors—for example, ODI, GemStone, and Versant. Vendors of transaction processing monitors are now morphing ORBs with traditional TP monitors—for example, BEA is building a scalable CORBA-based TP monitor on top of Tuxedo. The boutiques also include tool vendors—such as Symantec, ParcPlace, Borland, Penumbra, and Sybase—and big IT shops. This group also includes the major ISVs that gravitate in the Netscape, IBM, JavaSoft, and Oracle orbits.

into memory.

4. Applet invokes CORBA server objects. The Java applet can include IDL-generated client stubs, which let it invoke objects on the ORB server. The session between the Java applet and the CORBA server objects will persist until either side decides to disconnect. Note that you will need an IIOP-savvy firewall to make this work. Today, Iona's WonderWall firewall is the only game in town. But by the time you read this, Netscape might have shipped its own IIOP firewall.

5. Server objects can optionally generate the next HTML page for this client. After preparing the next pages, the server can tell the client what URL to download next. This dynamic HTML generation on the server side is typically not needed with the Object Web. A client application is packaged as a single HTML page with embedded components such as applets (or JavaBeans via the Object tag). In contrast to HTTP/CGI, CORBA lets you instantaneously interact with the server by clicking on any of the components embedded in the HTML layers without switching out of the page's context to obtain the response.

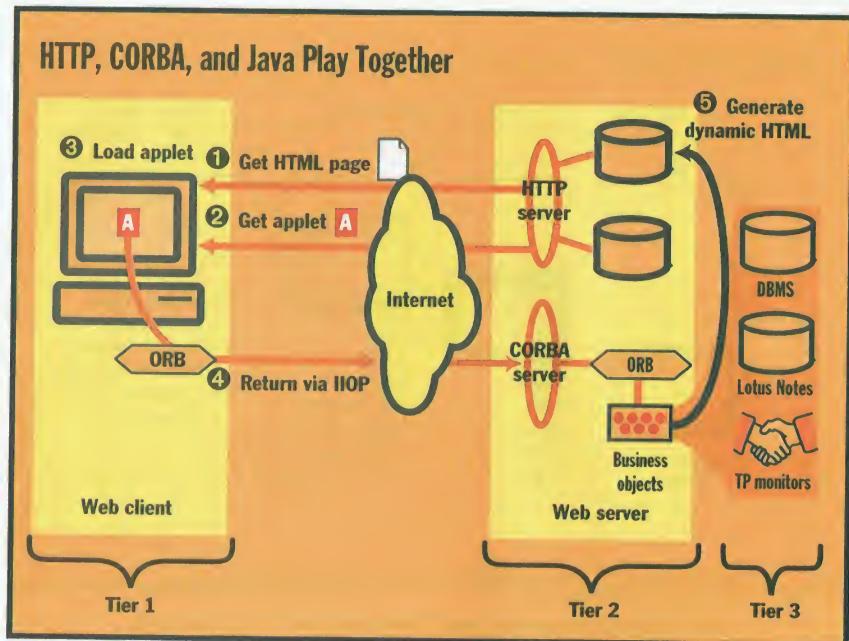
The technology we just described performs surprisingly well today. However, the Object Web is still under construction, as we explain next. Some key pieces will have to become available before we can declare the Object Web ready for mission-critical prime time.

## How CORBA/Java Augment Today's Web

Augmenting the Web infrastructure with CORBA/Java provides two immediate benefits:

1) CORBA avoids the CGI bottleneck. It allows clients to directly invoke methods on a server. The client passes the parameters directly using precompiled stubs, or it generates them on-the-fly using CORBA's dynamic invocation services. In either case, the server receives the call directly via a precompiled skeleton. You can invoke any IDL-defined method on the server, not just the ones defined by HTTP. In addition, you can pass any typed parameter instead of just strings. This means there's very little client/server overhead, especially when compared with HTTP/CGI.

2) CORBA provides a scalable server-to-server infrastructure. Pools of server business objects can communicate using the



A five-step process takes the browser from HTML to Java to CORBA client/server and back to HTML.

CORBA ORB. These objects can run on multiple servers to provide load balancing for incoming client requests. The ORB can dispatch the request to the first available object and add more objects as the demand increases. CORBA allows the server objects to act in unison using transaction boundaries and related CORBA services. In contrast, a CGI application is a bottleneck because it must respond to thousands of incoming requests; it has no way to distribute the load across multiple processes or processors.

## The Three-Tier CORBA/Java Object Web

All new applications on the Object Web will be built and packaged as components. You can use CORBA IDL to wrap existing code, written in almost any language, with object interfaces. For example, you could use CORBA to magically make a million lines of existing COBOL code look like an object (and eventually you might even masquerade it as a CORBA/Java-Bean). Any IDL-described object can now play on the Object Web in a first-class manner. This magic works because CORBA—like Java—maintains a clean separation between the interface of an object and its implementation.

Components require a thriving ecosystem to be commercially viable, and the Object Web provides one. The major com-

puting companies—including Sun, IBM/Lotus, Netscape, Oracle, Sybase, Novell, and BEA—are betting their shops on this killer app. They have chosen both CORBA/IIOP and JavaBeans as the common way to provide a high level of plug-and-play between their products. To understand what is going on, let's go over the three-tier client/server architecture of this emerging Object Web.

*The Client.* The first tier belongs to traditional Web browsers and the new Web-centric desktops (see "The New User Interface," July BYTE). As opposed to today's static Web pages, the new content will have more of the look-and-feel of real-world objects—for example, you'll see places that contain people, things, and other places. This very dynamic content is provided by ensembles of JavaBeans embedded in mobile containers, such as HTML pages or Jars, that contain shippable places. You will interact with these objects via drag-and-drop actions and other forms of direct manipulation. Client Beans will be able to interact with other client Beans in the container as well as with server Beans. In addition, server Beans will be able to invoke methods on client Beans using CORBA events and callbacks. Note that both IIOP and HTTP can run on the same networks. HTTP is used to download Web pages, Jars, and images; CORBA is used for Java client-to-server

# STATISTICA

NEW! '97 Edition

**STATISTICA** (automatically configures itself for Windows 95/NT [long file names, etc.] or 3.1) ■ A complete data analysis system with thousands of on-screen customizable, presentation-quality graphs fully integrated with all procedures ■ Comprehensive Windows support, OLE (client and server), DDE, customizable *AutoTask* toolbars, pop-up menus ■ Multiple data-, results-, and graph-windows with *data-graph* links ■ The largest selection of statistics and graphs in a single system; comprehensive implementations of: exploratory techniques with advanced brushing; multi-way tables with banners (presentation-quality reports); nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; stepwise logit/probit; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; confirmatory/exploratory factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; correspondence analysis; survival analysis; a large selection of time series modeling/forecasting techniques; structural equation modeling with *Monte Carlo* simulations; and much more ■ On-line *Electronic Manual* with comprehensive introductions to each procedure and examples ■ Hypertext-based *Stats Advisor* expert system ■ Workbooks with multiple *AutoOpen* documents (e.g., graphs, reports) ■ Extensive data management facilities (fast spreadsheet of unlimited capacity with long formulas, *Drag-and-Drop*, *AutoFill*, *AutoRecalculate*, split-screen/variable-speed scrolling, advanced Clipboard support, DDE links, hot links to graphs, relational merge, data verification/cleaning) ■ Powerful *STATISTICA BASIC* language (professional development environment) with matrix operations, full graphics support, and interface to external programs (DLLs) ■ Batch command language and editable macros, flexible "turn-key" and automation options, custom-designed procedures can be added to floating *AutoTask* toolbars ■ All output displayed in "Scrollsheets" (dynamic, customizable, presentation-quality tables with instant 2D, 3D, and multiple graphs) or word processor-style report editor (of unlimited capacity) that combines text and graphs ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000, virtually unlimited ANOVA designs) ■ Megafile Manager with up to 32,000 variables (8 Mb) per record ■ Unlimited size of files; extended ("quadruple") precision; unmatched speed ■ Exchanges data and graphs with other applications via DDE, OLE, or an extensive selection of file import/export facilities (incl. ODBC access to virtually all data bases and mainframe files) ■ Hundreds of types of graphs, incl. categorized multiple 2D and 3D graphs, ternary 2D/3D graphs, matrix plots, icons, and unique multivariate (e.g., 4D) graphs ■ Facilities to custom-design new graph types and add them permanently to menus or toolbars ■ On-screen graph customization with advanced drawing tools (e.g., scrolling and editing of complex objects in 32x real zoom mode), compound (nested) OLE documents, *Multiple-Graph Autolayout Wizard*, templates, special effects, icons, page layout control for slides and printouts; unmatched speed of graph redraw ■ Interactive rotation, perspective and cross-sections of 3D displays ■ Large selection of tools for graphical exploration of data: extensive brushing tools with animation, fitting, smoothing, overlaying, spectral planes, projections, layered compressions, marked subsets ■ Price **\$995**.

**Quick STATISTICA** (for Windows) ■ A subset of *STATISTICA*; comprehensive selection of basic statistics and the full analytic and presentation-quality graphics capabilities of *STATISTICA* ■ Price **\$495**.

**STATISTICA Industrial System** (requires *STATISTICA* or Quick *STATISTICA*) ■ The largest selection of industrial statistics in a single package; quality control charts (real-time data acquisition options), process capability analysis, R&R, sampling plans, and an extremely comprehensive selection of experimental design (DOE) methods ■ Flexible tools to customize and automate all analyses and reports (incl. "turn-key" system options, and tools to add custom procedures) ■ Price **\$995**.

**STATISTICA/Mac** (for Macintosh) ■ Price **\$695** (Quick - **\$395**).

Domestic sh/h \$12 per product; 30-day money back guarantee.

**STATISTICA has received the highest rating in  
EVERY comparative review of statistics software  
in which it was featured, since its first release.**

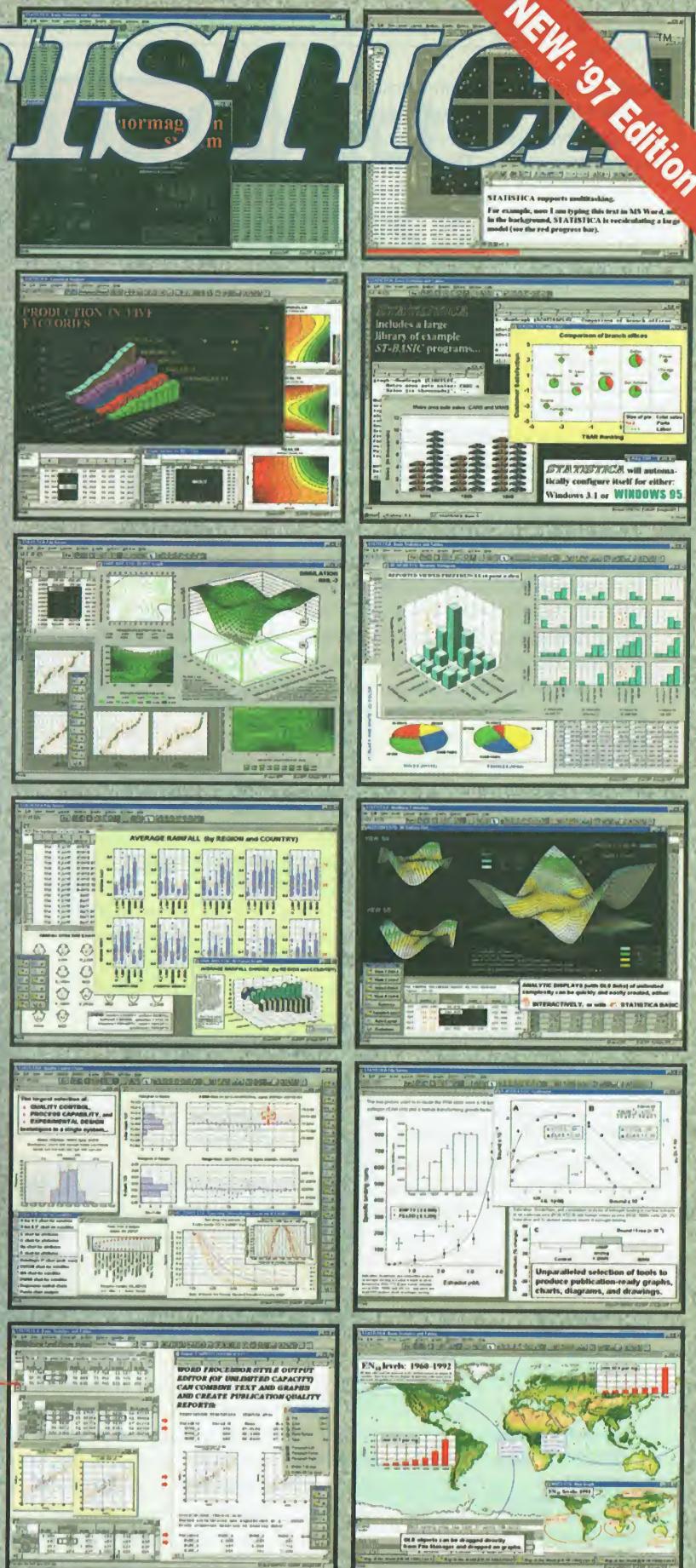


**StatSoft**®

2300 E. 14th St. • Tulsa, OK 74104 • (918) 749-1119  
Fax: (918) 749-2217 • WEB: <http://www.statsoft.com>  
e-mail: [info@statsoft.com](mailto:info@statsoft.com)

- StatSoft Ltd. (London, UK), ph: +44 1234 341226, fax: +44 1234 341222
- StatSoft GmbH (Hamburg, Germany), ph: +49 40/468866-0, fax: +49 40/468866-77
- StatSoft France (Paris, France), ph: +33 01-45-185-999, fax: +33 01-45-185-285
- StatSoft Polska Sp. z o.o. (Krakow, Poland), ph: +48 12-391120, fax: +48 12-391121
- StatSoft Italia (Padova, Italy), ph: +39 49-893-4654, fax: +39 49-893-2897
- StatSoft Pacific Pty Ltd. (Australia), ph: +613 9521 4833, fax: +613 9521 4288
- StatSoft Japan (Tokyo, Japan), ph: +813 3667 1110, fax: +813 3669 3100
- StatSoft Taiwan (Taipei, Taiwan, R.O.C.), ph: +886 2 5786587, fax: +886 2 5793179

The complete line of StatSoft products and training/consulting services are available from authorized representatives worldwide, including: Austria, Belgium, Brazil, Chile, Czech Republic, Denmark, Finland, Greece, Hungary, India, Korea, Malaysia, Mexico, The Netherlands, New Zealand, Norway, Portugal, Russia, South Africa, Spain, Sweden, Switzerland, Turkey. Please contact your nearest StatSoft office for the authorized representative nearest you. StatSoft, the StatSoft logo, STATISTICA, and Scrollsheet are trademarks of StatSoft, Inc.



and server-to-client communications.

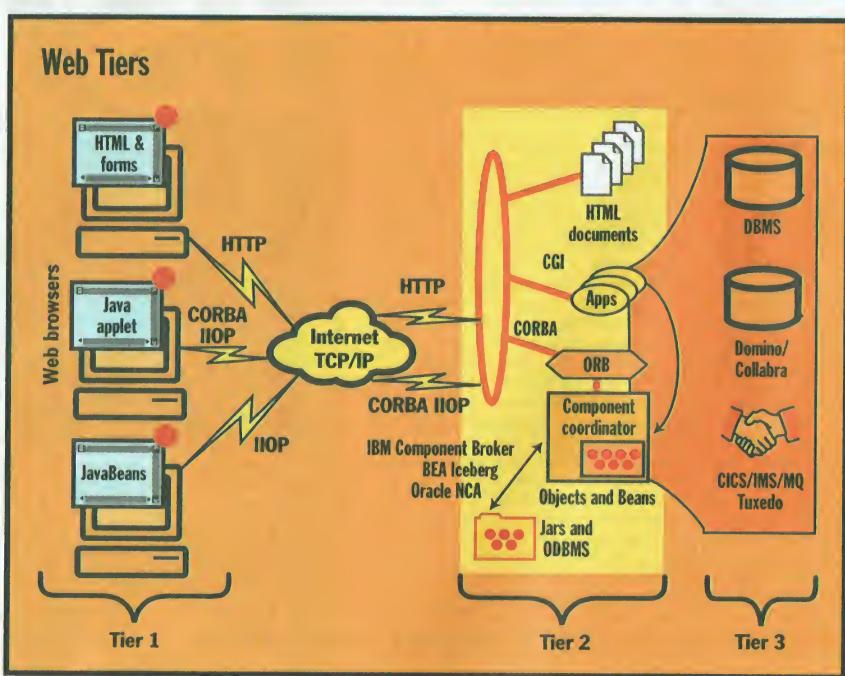
*The Middle Tier.* The second tier runs on any server that can service both HTTP and CORBA clients. This CORBA/HTTP combination is supported on almost every server OS platform—including Unixes, NT, OS/2, NetWare, MacOS, OS/400, MVS, and Tandem NonStop Kernel. CORBA objects—which could eventually be packaged as Enterprise JavaBeans—act as middle-tier application servers; they encapsulate the business logic. These objects interact with client JavaBeans via CORBA/IOP. Less scalable applications can also call these objects via scripts that run in HTML server pages—for example, Netscape's Web Application Interface (WAI) provides such a bridge.

The CORBA objects on the server interact with each other using a CORBA ORB. They can also talk to existing server applications in the third tier using SQL/Java Database Connectivity (JDBC) or other middleware. You can even use the CORBA/IOP server backbone as a general-purpose data bus. This is the technology Oracle is building for its data plug-ins. JDBC-on-IOP data backbones are available today from I-Kinetics and Visigenic.

The second tier must also provide a server-side component coordinator—also known as an object TP monitor. These component coordinators are TP monitors built on ORBs. Instead of managing remote procedures, they manage objects. The component coordinator prestarts pools of objects, distributes loads, provides fault tolerance, and coordinates multicomponent transactions. Without these component coordinators, you cannot manage millions of server-side objects—a key requirement of the Object Web. Examples of CORBA-based component coordinators are IBM's Component Broker and BEA's Tuxedo/Iceberg. But, what is a server-side component? It's

#### WHERE TO FIND

BEA	650-960-1300
Sunnyvale, CA	<a href="http://www.javasoftware.com">http://www.javasoftware.com</a>
800-817-4232	
408-743-4000	
<a href="http://www.beasys.com">http://www.beasys.com</a>	
IBM	
Somers, NY	
<a href="http://www.ibm.com/">http://www.ibm.com/</a>	
Java/Sanfrancisco	
JavaSoft (Sun Microsystems)	650-937-2555
Mountain View, CA	<a href="http://home.netscape.com">http://home.netscape.com</a>
800-528-2763	
Oracle	800-672-2531
	650-506-7000
	<a href="http://www.oracle.com">http://www.oracle.com</a>



The full-blown CORBA/Java Object Web involves an incredible mix of products and protocols.

a CORBA server object that also implements a minimum set of component services. A good example of this is the Oracle Cartridge. Cartridges are named CORBA objects that are also transactional, secure, and capable of emitting events.

A server component must also be toolable. This means that it must provide introspective interfaces that let you assemble it using visual tools. This toolable server-side component technology will be provided by CORBA-tized Enterprise JavaBeans. The CORBA/JavaBean technology is being integrated in visual builder tools from Symantec, Penumbra, ParcPlace, IBM/Taligent, Borland, and Sybase.

In a CORBA/Java Object Web, the second tier also acts as a store of component titles, HTML pages, and shippable places. These can be stored in shippable Java Jars that are managed by an ODBMS or DBMS. ODBMSes are better suited for the task.

*The Back End.* The third tier is almost anything a CORBA object can access. This includes procedural TP monitors, message-oriented middleware, DBMSes, ODBMSes, Lotus Notes, and e-mail. So the CORBA business objects replace CGI applications in the middle tier, which is good. Eventually, you will be able to get CORBA/Java components that encapsulate most of the third-tier functions. This is an area where CORBA's interlanguage com-

munications capabilities will come in handy. Look at some of the I-Kinetics work to understand what you can do with these back-end components.

#### Architectural Glue

CORBA and Java provide the architectural glue that connects products on the Object Web. This is our industry's first attempt to provide plug-and-play at the software product level, which is the ultimate open system dream.

In parallel, Microsoft is building its own rendition of the Object Web; it is based on DCOM and ActiveX. The Microsoft Transaction Server (nee Viper) is the DCOM component coordinator; it is Microsoft's secret weapon for ruling the Object Web. Currently, the Microsoft Web appears to be a single-anchor mall with tons of boutiques all running on Windows NT. So, let the games begin. ■

Robert Orfali, Dan Harkey, and Jeri Edwards are authors of many books, including *The Essential Client/Server Survival Guide* (Wiley, 1996) and *Client/Server Programming with Java and CORBA* (Wiley, 1997). Orfali and Harkey are distributed-object consultants for IBM and head the CORBA/Java Distributed Objects Lab at San Jose State University. Edwards is VP of strategy for BEA Systems, maker of Tuxedo. You can reach them c/o [editors@bix.com](mailto:editors@bix.com).

# Debunking Object-Database Myths

*Skeptical about ODBMSes? That's fine, but arm yourself with the facts first.*

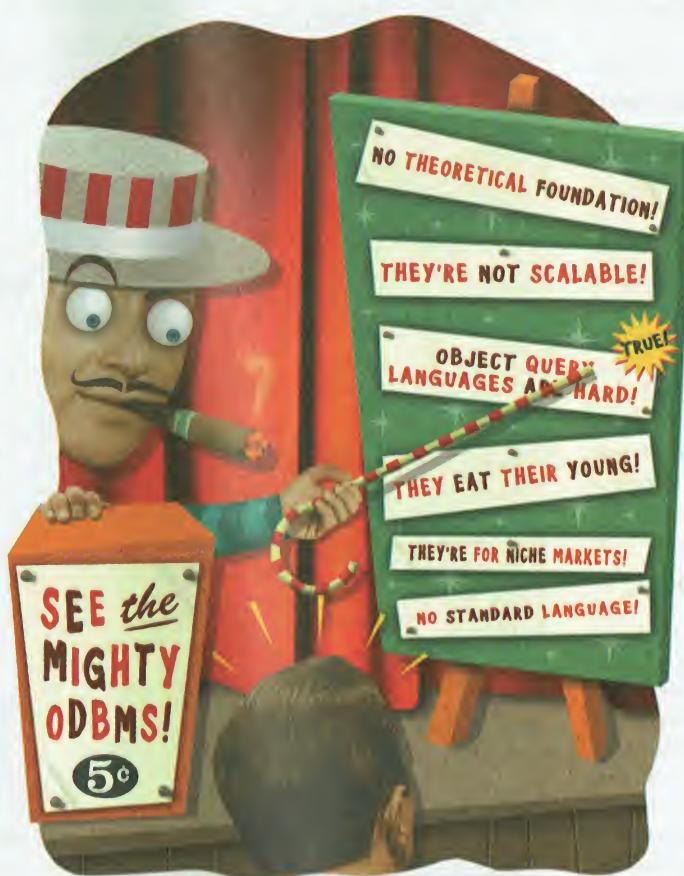
By Joe Celko and Jackie Celko

**O**bject-oriented database management systems (ODBMSes) were one of the hot ideas of the early 1980s. Objects were the next wave, so everyone was object-happy. Computer scientists working at universities and for large corporations developed prototypes. Developers scrambled for venture capital.

The only problem was that the early ODBMSes were not complete database systems. They lacked backup and recovery functions. Data models were conflicting. Languages were proprietary. Because of their structure, it was impossible to do true queries. ODBMSes were not scalable and required huge amounts of memory.

Many vendors backed away from the early ODBMS products. According to Jeff Jones, IBM's program manager of the data management marketing group in Santa Teresa, California, IBM tried to use a pure ODBMS as the embedded database in Visual Warehouse. It licensed Object Design's ObjectStore for the first releases of the product. However, performance was so poor that IBM replaced it with DB2 in later releases and wound up adding features and reducing the amount of code.

Experiences such as this made the ODBMS little more than a laboratory curiosity. Except for some niche markets such as telecommunications, ODBMSes remained, even for their supporters, a technology in search of a problem to solve. This is where conventional wisdom froze. As ODBMS technology and the needs of users changed, the conventional wisdom was that ODBMSes were inherently flawed. But they aren't. Let's take an updated look at six bits of conventional wisdom about ODBMSes. (For more information on ODBMS products, see the Software Lab Report on page 122.)



## 1. ODBMSes Are for Niche Markets

This is almost a truism. In some sense, every database product is designed for a niche market. According to the Meta Group, the relational DBMS (RDBMS) market in 1995 was \$2.5 billion, while ODBMSes had only a \$250 million market. Relational databases currently make up about 90 percent of the financial market.

However, relational-database advocates do not often mention that only 12 percent of all business-processing data is on RDBMS products. Most of the world consists of old file systems and legacy data. By this measure, the RDBMS is a niche product. RDBMSes are ideally suited for scalar data such as names, address fields, and amounts. They are extremely stable and fast. It is possible to execute complex queries. These features make RDBMSes ideally suited for business and financial applications.

However, the RDBMS model is based on sets of rows with columns, and it can be seen as 2-D. The object model allows for the complex modeling of objects as they exist rather than trying to squeeze the objects into a 2-D structure. The growing interest in multimedia applications and the Internet has created new markets for ODBMSes.

From that perspective, ODBMS technology is ideal for the most popular applications. The huge growth of the Internet, video games, multimedia applications, and the development of distributed databases that do not lend themselves to the relational model are bringing renewed attention to ODBMS. Because Java is an object-oriented language, Internet applications are particularly suited to object databases. Because there are now de facto and de jure standards for object technology, you can deploy

an application to the whole world.

Telecommunications is a good market for ODBMSes. We found several vendors whose products model and control communications networks in real time.

## 2. ODBMSes Have No Theoretical Foundation

This piece of the conventional wisdom is also true (although less so than in the past). But it ignores history. For example, calculus produced correct and usable results for over a century without a proper theoretical foundation. Newton's infinitesimals were just plain nonsense, and everyone knew it. The real question is whether an object database works for a given application, not whether it has a scientifically approved theoretical framework.

Relational databases have the advantages of a strong mathematical model and a set of well-developed tools for designing databases. ODBMS systems lack a firm theoretical foundation and have no well-developed design tools. Chris Date is particularly critical of this lack of theory in object databases. He and Huge Darwen wrote "The Third Manifesto," which goes into detail on this point.

But so what? A theory lets you design tools. For example, an RDBMS designer can use an entity-relationship diagramming tool to mathematically verify that his or her design is in third normal form. An ODBMS designer does not even have a concept similar to normal forms for his or her objects. Ultimately, the issue of tools is disappearing. For example, Computer Associates' Jasmine has a very good development environment.

## 3. A Relational Database Can Do Objects

No, it can't. If a vendor says it can, it is lying to you. Let's look at terminology.

You can classify database models as hierarchical, network, relational, object-relational, extended-relational, and object. Nobody cares about the hierarchical and network models anymore—the relational model replaced them. A relational database represents entities and relationships in tables that contain rows, that contain columns, and that contain scalar data-type values.

Nobody has any trouble telling apart products based on hierarchical, network, and relational models today. But when they were first introduced, programmers tried to make relational products

## Selecting an ODBMS

There are eight key areas to examine before making an object-database purchase.

**Language support:** What languages do you need—Java, C++, OQL? Some proprietary languages are faster than OQL, but choosing a product that uses a standard language will be more flexible and portable.

**Scalability:** What is the largest database the product will support? What is the largest database using the product that is up and running? How many users access the database at one time?

**Security:** How is security determined—by user, group, or both?

**Backup and recovery:** How does the product handle backup and recovery?

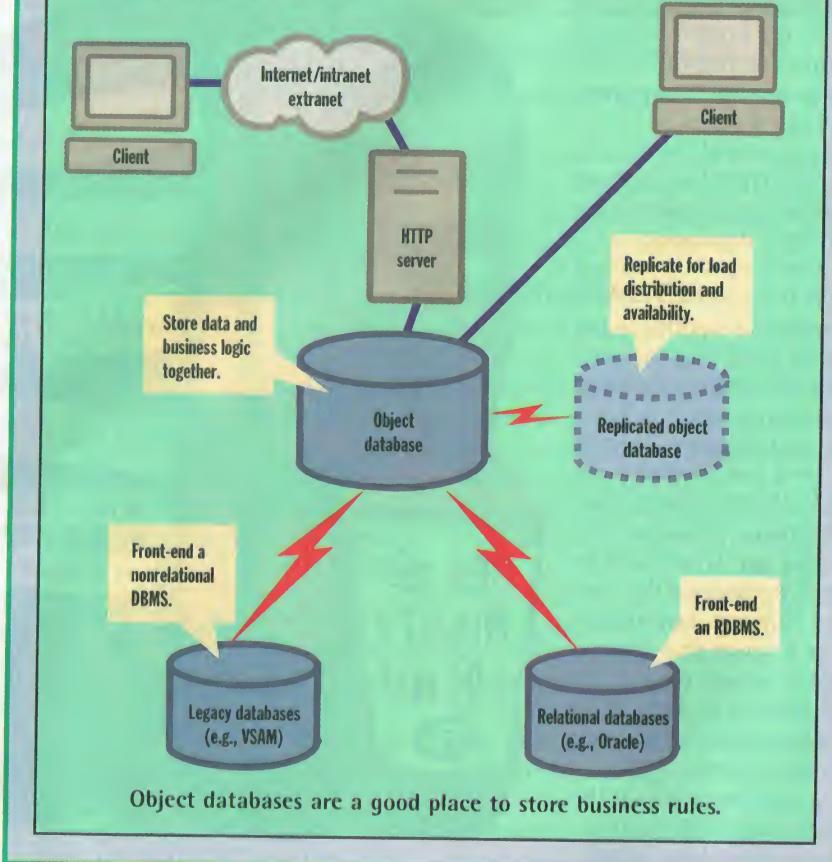
**Transactions:** Does the database allow for transaction logging, recovery, and rollback?

**Methods:** How does the ODBMS store methods? To be a true ODBMS, it should store them in the database itself.

**Collection classes:** What collection classes can the database handle? The ODMG, Java, and several object class libraries—notably STL—have defined certain common collection classes. Use of standardized collection classes increases portability and flexibility.

**Support and training:** What kind of support and training does the vendor offer? How long will it take to train your staff?

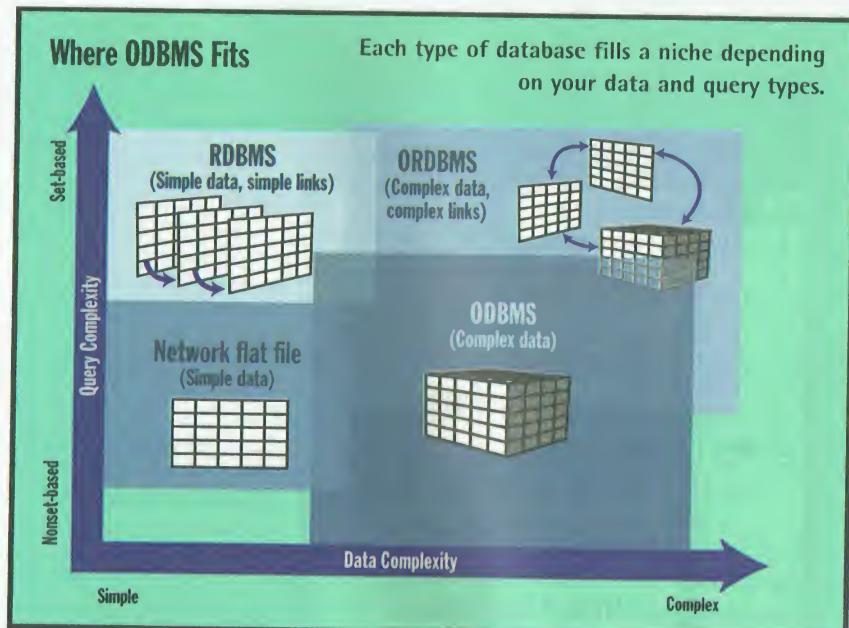
### What an ODBMS Can Do



behave exactly as a file system. It can be done, but at fantastic performance cost. Dare we say it? We needed a paradigm shift to appreciate the power of a relational system. As Jeff Jones points out, "The shift from IMS [an IBM hierarchical database product] to SQL was pretty

painful, because you also had to learn a new paradigm along with the new software. No one really wants to do that again with object databases."

Today, everyone is confused by the extended-relational, object-relational, and (pure) object databases. The biggest



## SQL3's Object Extensions

The SQL3 project aims to add object-oriented (OO) extensions to the SQL-92 syntax, making SQL object-friendly and enabling relational databases to handle more complex data types. But there have been some serious and fundamental problems with the SQL3 effort.

First, the committee began with a discouraging word in 1993, when Bjarne Stroustrup, the inventor of C++, said that he knew of four ways to store persistent objects and that they were all bad. He then stated that he believed the OO paradigm was good for programming but bad for data.

Second, the rules of the Standards committee require SQL3 to be upward-compatible with the current SQL-92 standard. Consequently, any ODBMS features must be cast into a syntax that might not be good for OO constructs. The solution is an informal agreement between the ODMG and NCITS H2 to make the queries in SQL3 and OQL

identical, or at least to overlap each other on most major points. But the schema declaration languages are still quite different.

Another area of concern is the interface. The 3GL host languages for which an interface to SQL-92 is defined (FORTRAN, Ada, C, M, COBOL, Pascal, and PL/I) have no basic disagreements about how to handle the scalar data types used in SQL. But C++, Smalltalk, Java, Eiffel, and several minor OO languages all disagree on OO fundamentals, such as inheritance, polymorphism, and encapsulation. OO vendors solve this problem with object brokers that automatically convert one object model to another one. Thus, the object database matches its host program.

There are political considerations. The object effort in SQL3 began with three sides, represented by Hewlett-Packard, Oracle, and IBM—three RDBMS vendors. Each had a different object model and different features to add to SQL3. Having little

experience with ODBMS, the committee approved proposals from all three companies. The internal contradictions and inconsistencies in the SQL3 draft document became so great that the ANSI X3H7 Object Standards committee sent a memorandum of concern to ANSI X3H2 on reviewing the document. Most of the current effort in SQL3 has been the cleanup of these problems.

Finally, in interviews we conducted, there was little endorsement of or enthusiasm for SQL3 from the ODBMS vendors. If they have to do it, they will. SQL3 will not be an approved de jure standard before 1999. By that time, the market will have established de facto standards. The most likely candidates for an object-database language are OQL and Java. OQL is already defined and has wide vendor support. Java is becoming the de facto language of the Internet, where the capability of ODBMS products to handle nontraditional data will shine.

problem that the pure ODBMS has is its name. The term should have been *object-base* instead of *object database*, because the goal is not to store, manipulate, and retrieve data within an object, but to store, manipulate, and retrieve objects themselves. Relational databases allow elaborate queries on simple data. Pure object databases allow relatively simple queries on complex data.

Object-relational products try to have both relational data and objects stored in one system. The difference is that the objects are added as an afterthought or a shell around the database rather than integrating them into the database engine. If you cannot tell the query optimizer, the indexing, and the database-engine functions how to handle the new data types invis-

## Objectivity

The Objectivity DB product from Objectivity is aimed at the high-end market—OEMs, ISVs, and large companies. Its customers include Motorola, Citibank, CERN, and Fermi Laboratories. Applications include process control, telecommunications, and scientific applications. The product provides real-time data acquisition and is extremely scalable. It has an ODBC tool that lets it use SQL for reporting. Backup and recovery include fault-tolerant options.

bly to the user, they are not integrated.

IBM and Oracle have object-relational offerings for their relational databases. To put it bluntly, the result is like a fish with feathers—it can neither fly nor swim very well. To quote Esther Dyson, "Using tables to store objects is like driving your car home and then disassembling it to put it in the garage. It can be assembled again in the morning, but one eventually asks whether this is the most efficient way to park a car." (Release 1.0, September 1988)

Chris Date advocates an extended-relational model, and Informix implements it with DataBlades. In 25 words or less, an extended-relational database allows the creation of more complex user-defined data types and integrates them into the database. But the operations are still relational, and data still exists in tables. This is a good approach for a particular class of common problems and should replace many of the existing simple relational databases, which do not need a full object

*Your  
Specialty*



*PCMCIA*



*Headquarters*



**quatech**

*... Application to Solution*

RS-232 • RS-422/485 • EPP

**1-800-553-1170**

Visit our website:  
<http://www.quatech.com>

**ObjectStore**

Database Data Views Publications

**Roots**

- CATEGORIES
- USERS
- \_ivitos\_meta\_knowledge
- RESERVATIONS
- PACKAGE\_EVENTS

**Classes**

- EXTRA\_PackageEvent
- EXTRA\_Reservation
- EXTRA\_User
- EXTRA\_UserProfile
- am\_os\_reference
- osmm\_indexable
- osmm\_types
- EXTRA\_Searchable

ObjectForms allows you to see what is inside an ObjectStore database and publish it to a Web site via simple point-and-click commands.

model. You could use an extended-relational database for employee records with fingerprints or a photograph but not for a multimedia library with interactive objects or for a model of the stock market.

A pure object database has methods, classes, and other things that characterize the object-oriented model in the database engine. Objects are active. Relational data is passive, and you need a host program to do something with it.

Don't confuse ODBMSes with extended-relational and object-relational products. They are designed to solve a different set of problems. To paraphrase Esther Dyson again, using a pure object database to store relational data is like keeping auto parts fully assembled into cars and disassembling the fleet when you need to count the screws you have in stock. One eventually asks whether this is the most efficient way to conduct an inventory.

#### 4. ODBMSes Have No Standard Language

SQL is literally the only NCITS/ISO standard programming language for databases and is relational. NCITS, the National Committee for Information Technology Standards, was formerly the ANSI X3 committee for information-processing stan-

Larry Alston, director of product management at Object Design, believes that an ODBMS allows true "multimedia" performance because objects are mapped directly. ObjectStore, Object Design's database product, is aimed at distributed Web applications as well as more conventional database applications. ObjectStore has been used in these areas: finance, education, publishing, and telecommunications.

ObjectForms allows you to see what is inside an ObjectStore database and publish it to a Web site via simple point-and-click commands.

#### Versant

Versant has the capability to dynamically modify its schema. Dynamic languages such as Java, Smalltalk, and C++ can define a class within an application, instantiate it, and then modify it. After this class modification, Versant will automatically and transparently evolve the instances of the modified class as they are used. In short, a class is as easy to change as an object.

dards before its name changed in January. (NCITS is pronounced "insights.")

The argument is that having a standard language has made relational databases less expensive to build and much more portable across products and platforms. ODBMSes have no such standards, so you have to work with strange proprietary languages and learn a new one each time. Therefore, the argument goes, they are not good for serious development work.

This wisdom is de jure true today, but not de facto true. In the next few years, it may be completely false.

While the ISO standards process was going on (see the text box "SQL3's Object

## Poet

According to Dirk Bartles, CEO of Poet Software, the Poet Object Database is the only object-database product designed for Windows applications. It is compact, with a footprint of less than 1 MB, and is comfortable on a single machine or on a network. Poet supports Java, C++, and ActiveX as well as OQL. Although there are no tools for backup and recovery, it does include transaction rollback and recovery features. There are Poet databases currently running in the 16-GB range with 150 concurrent users.

Extensions" on page 103), the Object Database Management Group (ODMG), a group of ODBMS vendors, began trying to set standards for object databases outside the ISO framework. The ODMG produced a standard for an ODBMS query language in 1993 under the name OQL. *The Object Database Standard*, edited by Rick Cattell (ISBN 1-55860-302-6, Morgan-Kaufmann), shows what version 2.0 of the project looks like. Sixteen vendors agreed to support OQL.

## 5. ODBMSes Are Not Scalable

Completely false. Yes, scalability was a major problem with early ODBMS products, because many of them could run only in main memory. If the machine went down, so did your database.

You can get small, medium, and large ODBMS systems. Small desktop systems include Poet. Medium enterprise-level systems include Versant, ObjectStore, and Jasmine. Large systems are at least terabyte-size and include a petabyte-size Objectivity DB project at the European Laboratory for Particle Physics (CERN).

These are real databases, with security, backup, and recovery features just like any RDBMS.

## 6. Object Query Languages Are Hard

This one's true. David Beech of Oracle submitted a paper to the H2 committee in March 1996. It gave a simple SQL3 schema using some new SQL3 declarations. The schema dealt with street addresses. The reader had to submit queries to answer a set of questions. Nobody on the committee submitted correct queries. These are

APPLE SYSTEM 7 • AT&T UNIX • INTERACTIVE UNIX • BANYAN • BANYAN • MOTOROLA 88OPEN • QNX •

PLATFORMS: WINDOWS NT • WINDOWS 95 • OS/2 • NLM

## Q: What does it take to build a superior client/server system?

A: A SUPERIOR SERVER

**START** with the most advanced client-side SDK on the market: c-tree® Plus at \$895.

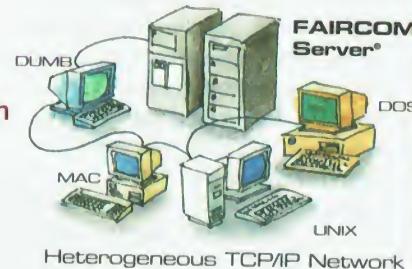
- Complete "C" Source code
- ROYALTY FREE (Client Side)
- Multiple supported protocols
- Fast, portable, reliable
- Powerful features like transaction processing
- Win95, NT, and Windows 3.1 ready

**ADD** a strong, multi-platform, industrial-strength Server that supports.

- File mirroring
- Heterogeneous networking
- Automatic disaster recovery
- Multi-threaded design
- Best price/performance available: from \$445-\$3745

**RESULT** economical, easy-to-deployable product that fits your needs.

- Portable
- Scalable
- Exceptional Performance
- Flexible
- Easy Server distribution
- Convenient OEM terms



You can't find a better client SDK with these features! Over sixteen years of proven reliability and performance. No one else supports over 30 platforms in this price range!

### c-tree Plus®

- Complete C Source
- Single/Multi User
- Client/Server (optional)
- Full ISAM functionality
- No Royalties
- Transaction Processing
- Fixed/Variable Length Records
- High Speed Data/Index Caching
- Batch Operations
- File Mirroring
- Multiple Contexts
- Unsurpassed Portability

### FairCom Server®

- Client/Server Model
- Transaction Processing
- Requires <2MB RAM
- Online Backup
- Disaster Recovery
- Rollback - Forward
- Anti-Deadlock Resolution
- Client-side "C" Source
- Multi-threading
- Heterogeneous networking
- File Mirroring
- OEM/Source Available

FOR YOUR NEXT PROJECT CALL FAIRCOM: YOU CAN'T FIND A BETTER HETEROGENEOUS CLIENT/SERVER SOLUTION!

Also inquire about these FairCom products:

d-tree™ r-tree® ODBC Driver

# FAIRCOM CORPORATION®

WWW Address: <http://www.faircom.com/>  
8 0 0 - 2 3 4 - 8 1 8 0

U.S.A. 4006 W. Broadway - Columbia, MO 65203-0100  
phone (573) 445-6833 fax (573) 445-9698

EUROPE Via Patrioti, 6-24021 Albino (BG) - ITALY  
phone (035) 773-464 fax (035) 773-806

JAPAN IKEDA Bldg. #3, 4f-112-5, Komel-chou - Tsu-city, MIE 514 Japan  
phone (0592) 29-7504 fax (0592) 24-9723

people with a lot of experience with SQL. If they had problems, what will the average programmer do?

Beech said: "Querying may be fun in the era of SQL-92, but will it still be so with SQL3? In the course of working on the SQL3/ODMG paper, I was obliged to become more intimately acquainted with SQL3 queries than I had ever been before, and I was surprised by some of the things I learned."

"This raised in my mind the question of whether the language has perhaps become too difficult for its intended users, which could mean that the potential simplification offered by some of the OQL features is not merely an optional luxury, but is an absolute necessity. ... Even if committee members solve them all correctly, it may seem that SQL users as a whole (the majority of whom are as yet unborn) would find the language error-prone and should therefore, if possible, be spared some of the problems and lengthy education. ... Its [failure to answer the problems] would show that even spending 40 hours with the query parts of the SQL3 foundation document may not be sufficient training for someone with 20 years' acquaintance with SQL and semiformal standards to be relied upon to write correct SQL3 queries."

## The New Conventional Wisdom

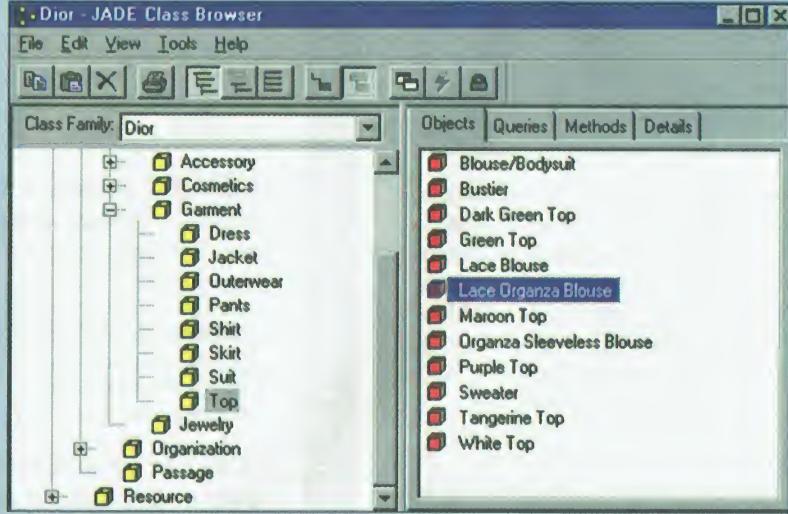
Object databases are back. They are still maturing, still misunderstood, and still hard to use. But they are gaining acceptance, thanks to the explosive, and somewhat speculative, growth of the Internet and multimedia applications.

Relational vendors that are making noise about object features added to their products are like the nonrelational vendors of several years ago who made false claims about relational features. The object-database model and the relational model coexist because they are designed for different applications.

Put another way: Don't fit the data to the database. Choose the database type and product based on what kind of data you have and how end users will access it. For example, a real estate firm that wants to do a database of home listings should choose a relational database if it will include only descriptive data, such as addresses and phone numbers. If the listing will include floor plans, text, or photographs, an object-relational database may

**Jasmine**

Computer Associates believes that object-relational databases cannot support complex objects completely. It tried for over six months to combine the two and could not come out with a viable hybrid. The company designed Jasmine in cooperation with Fujitsu to be an object-oriented database and application-development system that is multimedia- and Internet-aware. It has a small-footprint execution system so that it can become a Web-browser plug-in. Jasmine has a multimedia authoring tool and connectivity to the major relational databases. It comes with a class library, all packaged as JADE (Jasmine's Application Development Environment).



The screenshot shows a software interface titled 'Dior - JADE Class Browser'. The left pane is a tree view of a class hierarchy under 'Class Family: Dior'. The root node 'Dior' has several children: Accessory, Cosmetics, Garmet (with subnodes Dress, Jacket, Outerwear, Pants, Shirt, Skirt, Suit, Top), Jewelry, Organization, Passage, and Resource. The right pane shows a list of objects with icons: Blouse/Bodysuit, Bustier, Dark Green Top, Green Top, Lace Blouse, Lace Organza Blouse (which is selected), Maroon Top, Organza Sleeveless Blouse, Purple Top, Sweater, Tangerine Top, and White Top.

With Jasmine, you can drag objects directly from the database and drop them onto an application scene.

### WHERE TO FIND

Computer Associates, Inc.  
Islandia, NY  
516-342-5224  
<http://www.cai.com/products/jasmine.htm>

Object Design, Inc.  
Burlington, MA  
617-674-5000  
<http://www.odi.com>

Objectivity, Inc.  
Mountain View, CA  
650-254-7100  
<http://www.objy.com>

Poet Software Corp.  
San Mateo, CA  
650-286-4640  
<http://www.poet.com>

Versant Object Technology  
Menlo Park, CA  
650-329-7500  
<http://www.versant.com>

choose an object database, be sure that it will support the kinds of queries end users will be making.

A final word of warning: The shift to object technology may be hard because of the heavy financial and human investments in relational technology. Projects involving an object database will take longer with an inexperienced staff. But even if you're dealing with experienced object-database people, the project will take longer and be more costly because of the inherent complexity of object technology. If you're prepared for that, you're prepared for an object database. **B**

*Joe Celko has been a member of the NCITS H2 Database Standards Committee since 1987 and helped write the ANSI/ISO SQL-89 and SQL-92 standards. He is the author of three books on SQL: SQL for Smarties (Morgan-Kaufmann, 1995), Instant SQL (Wrox Press, 1995), and SQL Puzzles & Answers (Morgan-Kaufmann, 1997). You can reach him at 71062.1056 @compuserve.com. Jackie Celko is an Atlanta-based technical writer and researcher.*

be a better choice. If the database will include 3-D drawings, filmstrips, an animated walk-through, or a variety of complex data types, you should consider an object database. And if you do decide to

# Data Networks Speak Up

*Forget the promises of inexpensive long-distance rates. Can you really trust your voice network to frame relay or IP?*

By Alan Joch

**T**hink about it: You've already got that nice LAN wiring all over your building, connecting every office. Plus, you've got WAN connections linking all your remote locations. Using this existing infrastructure to carry telephone calls—without bothering the phone company's billing department—seems like a no-brainer. But nothing is that easy. The one accepted standard—frame relay—is fraught with internal dissension. Besides, IP is an important competing standard that you cannot ignore.

## Frame Relay: One for All?

Universally accepted standards: What a pain! Communications-hardware vendors all used to use proprietary compression technologies to squeeze voice traffic through frame-relay networks. But last spring, the Frame Relay Forum announced an interoperability standard, FREL11, that seemed to finally put an end to all that. For the first time, companies could shave 35 percent or more off their intracompany long-distance bills without committing to a single vendor's hardware and software.

The key to these glad tidings was G.729A, a voice compression/decompression (codec) protocol. Hardware vendors almost universally agreed that G.729A was good enough for toll-quality voice. In fact, the protocol provided nearly the same voice quality as the Public Switched Telephone Network (PSTN), which cost thousands of dollars a month more. Service that had previously cost a company \$120,000 annually cost only \$40,000 with frame relay. A bonus was the fact that interoperability could convince antsy customers that frame relay was mature enough to trust for both data and communications.

But the plot was thickening. The proposal was unraveling even

before the ink was dry. France Telecom North America (FTNA), the University of Sherbrooke, Lucent Technologies (based on work done at Bell Labs), and other companies had all provided some technology pieces to G.729A; each contributor now wanted a piece of the licensing action. Telephony vendors could end up paying dearly if they incorporated the codec in their systems.

How dearly? That was the other problem. Intellectual property claims were nearly impossible to sort out, leaving vendors in the position of ignoring G.729A in favor of each one's own proprietary codecs. So much for interoperability.

This was all the more painful because frame relay has improved its voice quality greatly. Two years ago, some disparaged frame relay because of annoying delays in two-way conversations. But although it's still not perfect, frame relay today almost equals PSTN under pristine network conditions.

Worse still, frame-relay fans must quickly sort out their problems now that a competitor, IP, has emerged. As corporations construct IP intranets, many see the next logical step to be voice services on those networks. Maybe. Headlines may buzz about voice over the Internet, but anyone who has listened to such calls knows that, right now, they're more

a parlor trick than a Fortune 1000-level solution. The real potential for voice on IP is for calls within an enterprise, to connect headquarters with remote subsidiaries—the very turf that frame relay has been trying to claim.

Now, as firms wonder if they should find alternatives to expensive long-distance service, they're also asking which is best. Frame relay and IP both offer hope for tomorrow's single-pipe data/multimedia dream. The big question: Is either technology mature



enough for you to commit now? Here's how to decide.

## Giving Frame Relay a Voice

Frame relay's variable-size packets efficiently do what their original design dictated: move blocks of data across WANs. Hardware at each end of a link handles error correction and flow control, so frame relay avoids the overhead burden of its older cousin, X.25. Plus, service providers typically sell frame-relay service for less than the cost of T1 or fractional T1 lines. That can add up to significant savings for data-intensive businesses.

If a company uses a public frame-relay network—offered by AT&T, MCI, Nynex, Sprint, US West, Wiltel, and others—it taps into the public frame-relay “cloud.” That saves it from having to buy its own routers and switches. (See the text box “Saving with Frame Relay” on page 109.)

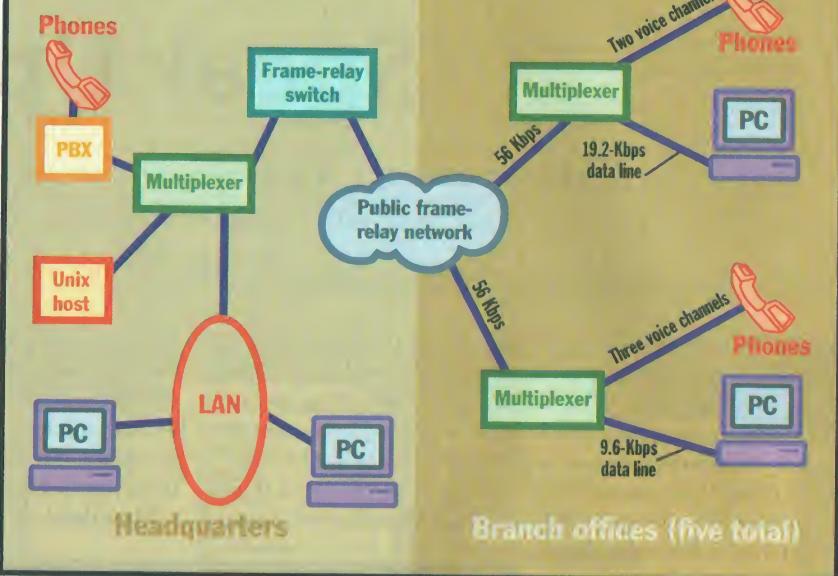
A bonus is *dual dial tone*, which reduces long-distance charges further (see the figure “Leaky PBXes” on page 109.) This feature—disparaged by long-distance providers—allows subscribers to call remote numbers for the price of a local call. A caller in New York, for example, dials a prefix number, sending the call to the frame-relay network, and hears the first dial tone. The caller then dials an outbound extension at a PBX in a remote office in, say, San Francisco, and hears a second dial tone. Then the caller can dial a remote customer as if making the call from San Francisco. Companies are reluctant to admit they do this, but one spokesperson said, “We hear it works just fine.”

Coastal Construction Products connects its Jacksonville, Florida, headquarters to six remote offices using frame relay. In 1995 came the decision to add voice to the fractional T1 and 64-Kbps data lines. “We knew that if we could run voice over those networks, we’d pay for any additional equipment from our reduced long-distance phone charges,” explains Jack Caven, MIS manager.

The company spent about \$55,000 for Micom equipment, including its software FRAD. (FRADs—frame-relay assembler/disassemblers—package data into frame-relay packets; today, vendors sell integrated hardware that combines traditional FRAD with routing, switching, and multiplexing.) The frame-relay link itself cost about what the former leased line did.

Caven estimates the company recouped its investment in 18 months, but reduced

## How to Send Voice over Frame Relay



A Miami food distributor needed only to add multiplexers and switches to send voice over its data network and cut phone charges.

costs were not the only benefit. “We began to have better communications within the office,” he explains. “Because we could call Miami as easily as calling the office next door, our people began to communicate more—not long conversations, but more short conversations to check availability of products.” Conference calls among remote staff members had previously been expensive, with the telecom provider patching calls together. “Now conference calls are free,” Caven adds.

With Coastal’s circa-1995 equipment, voice codec algorithms are old and compression is only to 16 Kbps (versus 8 Kbps, the current standard). Consequently, the system is primarily for intra-office calls.

### IP's Say

Voice over IP offers similar savings: Voice gateways produce a voice/fax layer on an IP intranet. Gateways can be simple. For example, Micom’s V/IP is a standard ISA card that plugs into a business-class PC connected to a PBX and a network. The V/IP card digitizes voice and puts it in IP packets (at the sending end) and unpacks the IP packets (at the receiving end). Similar PCs run at each remote facility.

IP-based intranets move voice and faxes through an enterprise well. And the Internet can be an important low-cost link for one-way calls, such as checking voice

messages or sending a fax while on a trip. And IP also provides dual dial tone.

IP gateways create a directory of phone numbers and IP addresses associated with each destination gateway. To place an IP-network call, users need only to dial a single-digit access number to reach the IP network, a number to reach the destination office, and, finally, an individual’s telephone extension. The gateway sets up the call (often in 1 or 2 seconds).

Vienna.way, a call-processing server in the Vienna Systems product family, performs traditional PBX duties so that users can place or receive calls through their PC’s IP gateway or a special serial-interface telephone. The server runs on Pentium PCs using Windows NT or Unix. Multiple Vienna telephony cards (with four or eight DSPs) in each PC can support up to 96 simultaneous calls to the PSTN. To handle more users, you can string together multiple servers.

VocalTec’s Telephony Gateway 3.0 provides similar capabilities using VocalTec software and Dialogic telephony boards. Unlike Vienna’s product, the VocalTec gateway runs only on NT (using 200-MHz or faster Pentium PCs). VocalTec recently announced Atrium, intranet software that conferences multiple callers, even if some use traditional telephones and others use PC connections to the IP network.

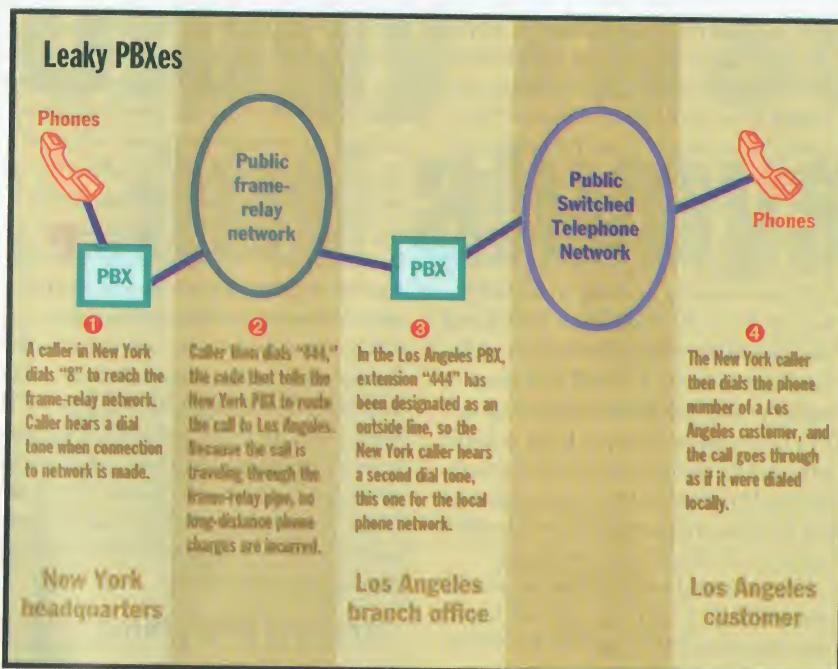
The software, which was due to ship this summer, costs \$2400 for a one-user license.

FTNA is currently testing voice over IP, using Micom's gateway boards. The project's first goal is to add telephony to the Sprint frame-relay data/e-mail network among the company's New York, Chicago, and San Francisco offices.

FTNA focuses on voice and fax over IP as part of intranet experimentation. It gets first-hand experience in future development of voice-over-IP services. "If we're running voice over IP at layer three [of the OSI model], we can use frame relay or ATM [asynchronous transfer mode]," says Jean-Francois Mulé, manager of information systems.

ABC Bücherdienst, a Regensburg, Germany, bookseller, is testing an innovative use of voice over IP. The company recently hired sales agents in Boca Raton, Florida, to handle inquiries from European customers after normal business hours. When Bücherdienst closes, the headquarters PBX routes sales calls over a leased line to Florida. A customer talks to a German-speaking sales agent and may not even be aware that the call has traveled outside Europe, despite some degradation in voice quality, according to Michael Gleissner, managing director.

"We're looking at the Internet as a way to enable us to shift our operations internationally without a huge telecommunications cost," Gleissner says. "It's hard to get experienced people in Germany who are willing to work at night." The system, which is about a month into a six-month beta test, provides many



Although service providers consider it wrong, frame-relay customers are able to call long-distance customers for free.

standard telephony features, such as voice mail and fax capabilities, Gleissner adds.

Lucent provided all the hardware, software, and services in exchange for the bookseller's being a test site. The system was not "plug and play": Lucent has been upgrading software, as often as twice a week, to tweak voice quality. But the quality of voice over the Internet is still volatile, depending on how the conversation connects. "You quickly figure out the call isn't going through the normal tele-

phone lines," Gleissner says. "But the quality is improving every week."

### Speech Quality Evolves

Such encouraging implementations of voice over data networks are a recent change. "If you asked me a year and a half ago if voice over frame relay had a chance to succeed, I would have said no," admits Tom Jenkins, broadband consultant for TeleChoice, a Verona, New Jersey, telecommunications consulting and market-research firm. "But I've changed my mind."

Voice over frame relay had earned a dubious reputation for high latency, taking over 100 milliseconds on average to send packets across a network. (The human ear starts to notice delays with latencies of 50 ms. At 300 ms, conversation becomes difficult. At 500 ms, conversations are annoying.) IP also suffers some of the same problems as frame relay.

A new generation of codecs, such as G.729A, not only compress conversations more efficiently but work with telephony applications that ingeniously interleave voice and data so that data sneaks through during the silences in all conversation. This is known as *silence suppression*. (A Bell Labs study found that silence can make up as much as 60 percent of a typical conversation.) Vendors estimate that silence suppression can reduce band-

### Saving with Frame Relay

Senior vice president Kevin O'Donnell helped launch voice over frame relay at Florida food distributor Bonacker & Leigh in 1994. The company sought to cut hundreds of thousands of dollars in annual long-distance charges for communications among its Miami headquarters and five remote offices.

The company's existing network had slow 9.6-Kbps dedicated leased lines with multiplexers for sending data from Miami to each subsidiary. A separate voice network was strung together with tie lines and inbound and outbound 800 numbers.

After spending about \$130,000 for ACT-net equipment, the company consolidated data and voice networks into one 56-Kbps frame-relay link. A multiplexer connects a frame-relay switch located at the Miami

headquarters with a Unix machine and the office's LAN, PBX, and fax machines. Multiplexers now turn voice, fax, and data into frame-relay packets. The switch then addresses the packets and launches them into a public frame-relay network (here, Intermedia Communications). Multiplexers at each remote office open the packets and send the data to the appropriate phone line, fax machine, or PC.

Because Bonacker & Leigh chose to install its own switches and multiplexers (rather than renting Intermedia's), it needed only the "raw" pipe into a frame-relay cloud. This cost about \$40,000 a year—versus the annual \$180,000 charges the company had been paying for the slower, parallel-network implementation, O'Donnell says.

width requirements by about 3.5 Kbps.

Compression algorithms vary widely in how tightly they squeeze voice signals, ranging from 32 Kbps to 4 Kbps. (Note: Older codecs didn't compress smaller than 32 Kbps—still a large chunk of bandwidth in 56-Kbps networks. Newer codecs, such as G.729A, offer higher compression—8 and 4 Kbps—with relatively high voice quality.) Common codecs include pulse code modulation (PCM) and adaptive differential pulse code modulation (ADPCM), used by PSTN in the U.S. and by postal, telephone, and telegraph (PTT) systems in Europe. Both achieve high-quality audio with unnoticeable latencies. Unfortunately, they consume 64 and 32 Kbps, respectively, unacceptably high for a 56-Kbps frame-relay pipe.

Algebraic code-excited linear prediction (ACELP), a more recent technique, underlies the G.729A standard for 8-Kbps compression. ACELP can produce "near-toll-quality" sound in subjective tests.

G.729A is a cousin of G.723, the compression scheme pushed earlier (as part of H.324) by Intel and Microsoft for videoconferencing over PSTN. G.729A was developed because G.723 needs significant computing—about 30 percent of a standard Pentium 100's power. G.723 also has a longer frame size—30 ms—resulting in 90- to 100-ms latencies. With a smaller frame size of 10 ms and only 30- to 35-ms delays, G.729A became a simpler and higher-quality choice for voice applica-

tions. (Latency is 3 to 3½ times frame size.)

Still, G.729A might never see widespread use. Even representatives from companies that helped develop the specification secretly hope a single company will offer a better alternative that's unsaddled by licensing problems. Nevertheless, networking analysts see this as a significant, if incomplete, gain. "It sends the right signals" that the industry is working to make voice over frame relay viable, Jenkins says.

Voice hardware also can control the flow of different data types. Because voice and fax communications break down if there is too much delay, FRADs and gateways give them higher priority when packets travel through the frame-relay pipe. Data traffic remains in the sending hardware's buffer until the hardware sends the higher-priority packets.

### Timing Is Everything

For the time being, and even if G.729A finds resolution, your safest choice still is to buy FRADs from a single vendor. Unresolved standards issues beg the most fundamental question for both frame relay and IP: Is the time right to combine your voice and data traffic?

The answer: Only for select applications. Neither technology offers enough quality for a large corporation to scrap traditional voice services. For example, Kevin O'Donnell, senior vice president at Florida food distributor Bonacker & Leigh, says he has noticed steady improve-

ments in voice over frame relay in the past two years. But the quality still is not high enough "to talk with my best customers." For internal conversations, however, especially after workers get used to slight delays, frame relay is acceptable. "When you're saving \$15,000 a month in long-distance charges, you get used to the sound quality pretty fast," O'Donnell quips. (See the figure "How to Send Voice over Frame Relay" on page 108.)

Mulé estimates that 90 percent of FTNA's New York-to-San Francisco calls travel over the IP network. His rating of IP voice quality? "Pretty good for our internal purposes." Unlike over the Internet, you can control the quality of calls over a private intranet.

Nevertheless, the relatively short payback times of hardware costs for voice over frame relay or IP make it easier for large companies to commit part of their voice services to one of these technologies. Long-distance savings can pay for a FRAD in half a year, so even if the technology changes in a year or two, you will probably recoup your costs. (Voice-capable FRADs range from about \$2000 to \$10,000, with most in the \$4000-\$6000 range.) And once you launch a combined voice/data network, later transition to one-stop-shopping services is easier.

Just don't expect comfort in numbers: Today, according to Jenkins, voice represents only about 3 percent to 5 percent of the traffic over frame-relay networks. De-

## Hopping the Networks

Some companies might consider sending voice over their frame-relay network, then over an internal IP network, and perhaps even over the Internet. Today's FRADs and gateways theoretically make this possible, but the practical benefits are unclear.

An IP gateway could encapsulate voice into IP packets: Workers within a company could converse from PC to PC. The IP packets could then go to a FRAD. The FRAD would enclose the IP voice packets like a nested box within a frame-relay packet, then across the company's WAN to a remote site. There, another FRAD would strip off the frame-relay envelope and send the IP packet across the

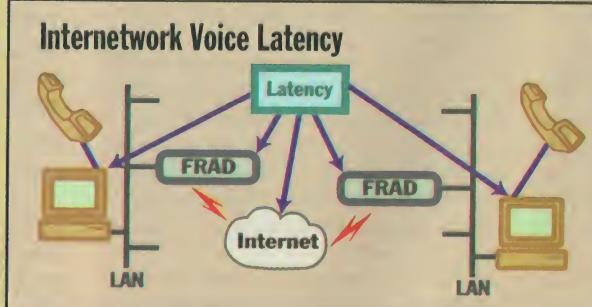
LAN. At the destination PC, the IP packet would disappear, and the

one step further. Most service providers can connect their frame-

could jump off onto the Internet.

That's the potential; the practical aspects of network hopping are plagued by the high overhead of all that packing and unpacking. Today's codecs might compress the voice data to 8 Kbps; however, an extra 7 Kbps in overhead might be needed to send the data, according to TeleChoice's Tom Jenkins. The result is more degradation in voice quality than what users already experience with voice over frame relay or IP.

Jenkins adds that he doesn't expect network hopping to be significant in the evolution of voice over data. "Companies are more likely to choose frame relay or IP," he says.



Network-hopping your voice traffic is possible, but the latencies it introduces make it impractical.

message would turn into voice.

The capability exists to take this

relay networks to the Internet so that, along the way, the voice data

# Technology First ...and always

Hey, nice rack!  
-liz-

Progressive industries need comprehensive network solutions. Integrix has developed an intelligently designed series of industry standard SPARC based, high availability (HA) servers, and compact RAID storage units for rackmount environments.

#### Distributed Servers

The RS1 and the RS2 offer single and multi CPU systems, with UltraSPARC™ technology in a compact rackmount design. Removable canisters on the front panel provide hot swappable access to hard drives. A remote diagnostic monitoring feature protects your mission critical data by alerting the user to system irregularities.

#### Maximum Uptime

The iNetServer200 is a custom configurable solution with hot swappable redundant hardware allowing you to work with applications such as web servers, NFS file systems, and relational databases. With HA software installed as an option, the iNS00 maintains communications between two system boards maximizing your uptime.



#### Compact Storage

The RD15 offers a standard Ultra wide SCSI interface that will connect to virtually any standard server in the industry. A 4U chassis houses up to 100GB of storage, redundant

power supplies, and modular cooling. A Java based GUI management system alleviates the inconvenience of administration. The RD15 is safe, fast, and reliable storage.

Put your enterprise first with Integrix technology. Call us today!

\*The Integrix Rackmount family is a modular design. All products shown are available as stand alone units.

#### Corporate Headquarters

2001 Corporate Center Drive  
Newbury Park, Ca. 91320 USA  
Tel: 800-300-8288 / 805-376-1000  
Fax: 805-376-1001  
E-mail: sales@integrix.com  
<http://www.integrix.com>

#### Asia

Beijing, P.R. China  
Tel: 86-10-6253-5305  
Fax: 86-10-6253-5306

#### Seoul, Korea

Tel: 82-2-515-5303  
Fax: 82-2-515-5302



spite alluring cost-savings potential, many companies are reluctant to commit to the technology because of equipment that changes rapidly and, ironically, a lack of standards. Also, frame-relay and IP can't yet provide advanced telephony features, such as cost allocation and minute-by-minute call tracking.

By the year 2000, even if standards work out, voice may not reach 10 percent of frame-relay traffic. This is partly because companies don't want their communications to be jeopardized by network downtime, and partly because of intract-

able turf wars between communications and information-systems (IS) managers. "Turning all your voice services over to the IS department isn't a good move for empire-building," Jenkins says.

### How You Choose

If you have the pioneer spirit and are ready to run part of your voice communications over a data pipe, first prepare yourself. Hardware vendors will bury you with proof of how each FRAD or IP gateway offers the best voice quality. Instead, do your own investigating: Bring loaner

equipment into your organization for real-world testing. While service providers theoretically supply the same frame-relay services, customers note anomalies that are seemingly dependent on how calls get routed within a single enterprise. "We recently upgraded our multiplexers at each office, and invariably one or two of the sites couldn't use the frame-relay system," says O'Donnell. His suspicions focus on differences in how data travels to each location when it comes down from the fiber-optic backbone.

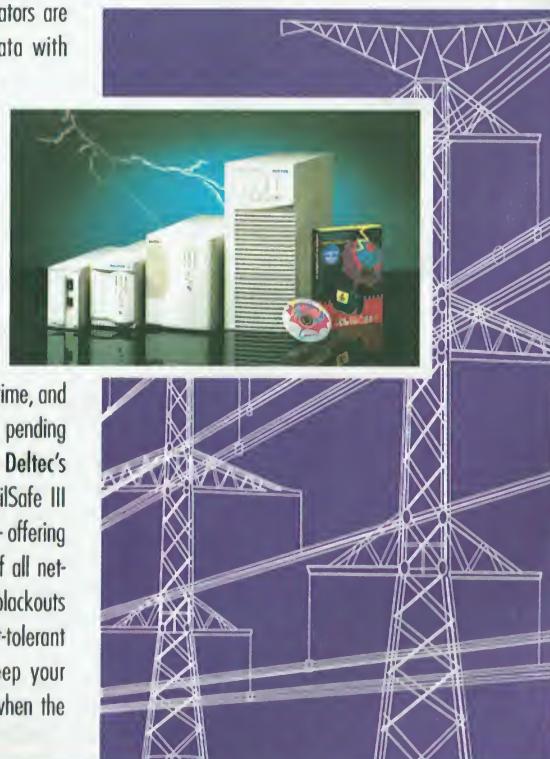
Jenkins suggests asking hardware vendors for recommendations for frame-relay service providers, and asking service providers for hardware recommendations. Try to test equipment from several vendors at the same time for comparisons. Audio quality is highly subjective, and

## Don't Get Caught with Your Power Down...

**When it comes to choosing something as important as a UPS, it's foolish to fly by the seat of your pants.**

That's why network administrators are safeguarding their critical data with **Industrial Strength**

**Power Protection** from **Deltec**, the largest supplier of OEMs in the industry. Fortune 100 companies choose **Deltec** UPSs for their array of exclusive features, such as Advanced Battery Management (ABM™) — which doubles battery service life, optimizes recharge time, and provides advanced warning of pending battery failure. Combined with **Deltec's** proprietary LanSafe III and FailSafe III power management software — offering automatic, orderly shutdown of all network devices during extended blackouts — **Deltec** UPSs ensure a fault-tolerant environment, designed to keep your system up and running even when the power goes down.



Call Now: 1-800-DELTEC-1



Win Prizes at our Web site —  
<http://www.deltecpower.com>  
or e-mail: [info@deltecpower.com](mailto:info@deltecpower.com)

**DELTEC**



### WHERE TO FIND

ACT Networks Camarillo, CA 805-388-2474 <a href="http://www.acti.com">http://www.acti.com</a>	Vienna Systems Kanata, Ontario, Canada 613-591-3219 <a href="http://www.viennasys.com">http://www.viennasys.com</a>
Micom Communications Simi Valley, CA 805-583-8600 <a href="http://www.micom.com">http://www.micom.com</a>	VocalTec Northvale, NJ 201-768-9400 <a href="http://www.vocaltec.com">http://www.vocaltec.com</a>

comparisons might be the only way to quickly judge how well the hardware is delivering high-quality voice data.

Voice over IP, on the other hand, benefits from the widespread commitments to intranets that companies everywhere are making. "A corporation needs an intranet," Mulé says. "Once it builds a full TCP/IP network, adding voice to it becomes a good solution. You just put gateways where you need them."

### Solution Sells

Once single pipes routinely handle voice and data, debate over frame relay versus IP will probably become irrelevant. Instead, service providers will sell results rather than technologies. Your traffic might use frame relay, IP, ATM, or combinations of each. "We won't see service providers selling a technology," says Jenkins. "Instead, they'll say, 'connect into my network; we'll deliver the data.'"

Alan Joch, a former BYTE senior editor, is a freelance writer who covers emerging technologies. You can reach him at [ajoch@monad.net](mailto:ajoch@monad.net).

# Web Project



## Next-Generation News Servers

Over a year ago, I started BYTE's public newsgroups on a Linux server running the standard Internet news server, INND. There they remain, because the setup continues to work nicely. More recently, the BYTE staff has begun to collaborate privately in a different set of newsgroups. I could have used INND for these as well, but instead I've been experimenting with two newfangled INND derivatives: Microsoft's Internet News Server (INS) and Netscape's Collabra Server.

These new groupware servers are more approachable—and, in some respects, more powerful—than INND. Deploy one alongside your Web server, and you will reap some enormous benefits. Thanks to the latest generation of HTML-aware newsreaders (see last month's "HTML + NNTP = Groupware"), news servers have become, in effect, read/write Web servers.

With these servers, users can exchange not only plain ASCII files but also rich HTML documents enhanced with styling, links, graphics, binary attachments, and active content. Visitors to your public newsgroups (anyone, anywhere, anytime) and users of your private newsgroups (your staff, also anywhere, anytime) can use the same client software: Netscape Navigator or Communicator, or Microsoft Internet Explorer (MSIE).

Why does this matter? Here's one key benefit: Collaborators can flexibly manage the scope of their collaboration.

### Information Scoping

I run a set of private newsgroups just for my own team—BYTE's three-person New Media department. Another set of newsgroups is accessible to the entire BYTE staff. Finally, BYTE's public news-

groups are world-visible. Because I use the same client to participate in all three realms, I can respect boundaries—or cross them—as it's appropriate.

For example, we New Media team

Try out the latest Internet news servers from Netscape and Microsoft, and you'll see why NNTP is fast becoming the foundation for Internet-based groupware.

sons for privacy, why not tap into the collective brain trust at work in BYTE's public newsgroups?

The scope of collaboration doesn't always expand. Sometimes discussion

When you need to mirror one server to another, you appreciate how both Collabra and INS hide the details.

members use our private newsgroups to document the ever-changing procedures and configurations that underpin The BYTE Site. Much of this chatter would only annoy the rest of the BYTE staff, but it's vital to us. We post a stream of messages not only to communicate with each other but also to document what we do so that we (or perhaps a future new team member) can recover this knowledge three or six months from now.

What if our private discussions raise issues that are relevant to other groups? If it's a matter of BYTE policy, the proper scope may be another BYTE department or the entire BYTE staff. If it's a general issue, though, the proper scope might be global. Unless there are rea-

needs to move from public space to private space. For example, I've just started a public on-line focus group for our marketing team. Issues raised there will probably need to move into private space for internal debate.

### Newsgroup Access- Control Strategies

Conventional INND servers create zones of private discussion using a control file called `nnrpd.access`. Here's how I might create a world-visible group, a staff-wide group, and two departmental groups:

`*:Read,Post:::public_forum`

`*:Read,Post:edit:ep:staff_forum,`

```
edit_forum
*:Read,Post:sales:sp:
staff_forum,sales_forum
```

These lines say: "Any IP host (\*) can read and post to public\_forum. Allow only user edit (password *ep*) or user sales (password *sp*) into staff\_forum. Only user edit can get into edit\_forum. Only user sales can get into sales\_forum."

What's hard about this? Nothing at all, once you've got INND up and running. But

## BOOKNOTE

### Software Reuse: Architecture, Process and Organization for Business Success

\$44.06

by Ivar Jacobson, Martin Griss, and Patrik Jonsson

ACM Press/Addison Wesley Longman

ISBN 0-201-92476-5

<http://info.acm.org>;

<http://www.awl.com/cseng>

You know that times have changed when OO guru Ivar Jacobson offers ActiveX a seat at the table. This pragmatic treatise on software reuse focuses on results while celebrating a variety of both object-oriented and component-based means.



that can be a big hurdle. Other than Internet system administrators charged with providing Usenet service for companies or Internet service providers (ISPs), very few people have ever used INND.

That could change in a hurry, though. Microsoft and Netscape have given INND a pretty face that won't intimidate regular folks. Anyone who's comfortable deploying these vendors' Web servers should also be able to deploy their news servers. [Editor's note: *The version of INS that I use comes with the Microsoft Commercial Internet System (MCIS) and is not generally available. Another version of INS will be included in the forthcoming IIS 4.0. I haven't tried that version yet, but Microsoft says that it's comparable to the MCIS version.*]

Ironically, both require more configuration effort than does INND to achieve the four-zone setup illustrated above. But since the task involves tabbing through

## To Replicate or Not to Replicate?

Every night, vast quantities of data replicate across the worldwide network of NNTP servers that is the Usenet. Making these feeds run smoothly is a tricky business, and it accounts for much of INND's feared complexity. As I've explained elsewhere, though (see "Let's Talk," May 1996 BYTE), you can radically simplify matters by running INND in stand-alone mode. BYTE's public and private newsgroups originally worked this way.

We had some problems, though. First, our corporate firewall wouldn't let NNTP through. Then that got fixed, but bandwidth constraints made it hard to use NNTP effectively. (NNTP is connection-oriented and thus more sensitive to marginal network conditions than stateless HTTP is.) So I reluctantly got into the replication business. I started using NNTP feeds to mirror our world-visible (i.e., outside) servers to a set of firewall-protected (i.e., inside) servers. When working at home or on the road, we can use an outside server. From any of our three primary intranet-linked offices, we can use the corresponding inside server. Replication keeps everything in sync.

Despite my trepidation, this scheme was easy to set up (see the screen on page 113) and has worked reliably. Now that our firewall and bandwidth problems are solved, I'll probably turn off replication. As the administrator of all this stuff, I like to minimize the number of moving parts. But I'm glad to have added NNTP replication to my arsenal. I may need it again someday.

dialog boxes and mouse-clicking, rather than hand-editing Unix-style configuration files, many users who regard INND with terror will embrace INS and Collabra. To all you Unix graybeards: Don't rush to mock those who prefer the new breed of news server. INS and especially Collabra do things that INND can't: Secure Sockets Layer (SSL) encryption, client authentication, integrated full-text search. These features transform INND into a compelling groupware platform.

Although they're comparably easy to use, the Microsoft and Netscape news servers differ radically in their methods of access control. Microsoft's INS integrates with Windows NT's stand-alone or domain security. Netscape's Collabra relies on a local or remote LDAP database. Both approaches have pros and cons (see the text box "Comparing NNTP Access-Control Methods" on page 116).

Which approach is best? All other things being equal, I would recommend INS for an NT-based, intranet-only solution, and Collabra for Unix hosting or for a mixed Internet/intranet clientele.

Either server can accept connections over an SSL-secured channel. That puts you a step ahead of the standard INND, which sends user names and passwords in the clear. The SSL capability may or may not matter for an intranet deployment. But it matters greatly if you locate company-private content on a world-visible server.

Why do that? Collaboration knows no bounds. Documents that your coworkers share with you in NNTP conferences do

you no good if you're at home or on the road and can't reach through the firewall to read them. Cleartext authentication using NNTP's authinfo command is only the weakest kind of security. SSL sessions encrypt your credentials as well as the data that flows between news clients and servers. To enable SSL, you need a digital certificate for your news server, just as you need one to secure your Web server (see "Digital IDs," March BYTE).

If you're running INS for a homogeneous population of Windows clients, there's a middle-ground option. You can use NT's challenge/response authentication protocol. In that case, session data won't be encrypted, but credentials will be. That's still a big improvement over cleartext authentication.

## Managing Shared Documents

NNTP conferences are starting to look more and more like Lotus Notes document databases. That's partly a function of HTML-aware newsreaders. Many of the advanced features I discussed last month flow from NNTP clients, not servers, and so they work with legacy INND servers as well as with Collabra or INS. But two Notes-like features in Communicator's Collabra client—full-text search and categorization—require Collabra Server.

Collabra Server comes with its own search engine—unlike INS, which instead relies on Microsoft's generic Index Server. Collabra could (and perhaps eventually should) similarly leverage Netscape's



PHOTO COURTESY OF NASA

# It pays to be well-connected. Just ask your modems.

High-speed modems are only as good as the ports they're connected to. And no one connects modems like Central Data.

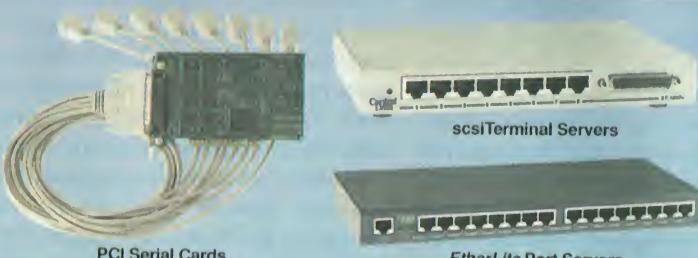
Our popular **scsiTerminal Servers**™ attach superfast serial ports (up to 230K baud) to the SCSI bus—without using any card slots inside your workstation or server. And our **EtherLite® Port Servers** connect real local ports via Ethernet. They're much easier to install and administer than conventional network terminal servers. And for lower-cost solutions, check out our new **PCI Serial Cards**.

Central Data serial ports are compatible with Windows NT RAS, SCO UNIX, and UNIX systems from Sun, HP, IBM, DEC, and Silicon Graphics.

Don't trust your modem connections to anyone else. Call 1-800-482-0397 today for a **FREE** evaluation. Or view our website at [www.cd.com](http://www.cd.com).

## U.S. Robotics® CHOOSES CENTRAL DATA

When U.S. Robotics needed serial ports to test their new x2™ Modems, they chose Central Data. Our new 230K-baud scsiTerminal Server was the only solution they found that could handle the sustained throughput of their 56K technology.



1602 Newton Drive • Champaign, IL 61821-1098 • (217) 359-8010 • (800) 482-0397 • FAX (217) 359-6904 • [info@cd.com](mailto:info@cd.com) • [www.cd.com](http://www.cd.com)

Copyright ©1997 Central Data Corp. All rights reserved. EtherLite is a registered trademark and scsiTerminal Server is a trademark of Central Data Corporation. UNIX is a registered trademark in the U.S. and other countries, licensed exclusively through X/Open Company, Ltd. Windows NT is a registered trademark of Microsoft Corporation. U.S. Robotics, the U.S. Robotics logo, and x2 are registered trademarks or trademarks of U.S. Robotics. All other brand or product names are or may be trademarks of their respective owners.

# Central Data



general-purpose indexer/searcher. But for the 3.0 server, Netscape chose—I think wisely—to focus on tight coupling with the Collabra client.

The two products jointly implement a search protocol that Netscape has proposed as an extension to the NNTP standard. As a result, you can search newsgroups directly from the newsreader. And, crucially, a user not permitted to read a newsgroup won't ever see a search hit from that newsgroup. This secure search capability would be difficult to achieve with INS and Index Server—or, indeed, with any mechanism (such as The BYTE Site's conference searcher) that operates in Web

## TOOLWATCH

### Business::CreditCard

(free)

Jon Orwant <[orwant@media.mit.edu](mailto:orwant@media.mit.edu)>  
<ftp://ftp.cis.ufl.edu/pub/perl/CPAN/modules/by-module/Business/>

If you're using Perl CGI scripts to take credit-card orders, don't reinvent the wheel. Here are the routines you need to identify card types and check the validity of card numbers.

space rather than in NNTP space.

Collabra can also create customized views of discussions. It does this in two ways: categorized newsgroups and virtual newsgroups. If the Collabra Server administrator declares a newsgroup as a categorized one, its subgroups interact with the otherwise-inactive "Show Categories" feature of the Collabra client.

When I tried this, I solved a mystery. The newsreader's third (newsgroup) pane has vanished in Collabra, apparently replaced by the Message Center, which runs as a separate application. But when you point the newsreader at a categorized discussion, the missing third pane reappears. That's how Collabra displays categories.

However, this is only marginally useful to me. Legacy newsreaders don't see the categories, and since I support a mix of newsreaders, there's no incentive to create them. I'd rather have the third pane back as it was in Navigator.

Virtual newsgroups are more interesting. In last month's column I showed a Collabra-based full-text search for the term *vpn*. When I used the search dialog box's Save As button, Collabra performed a neat trick. It created a newsgroup called

## Comparing NNTP Access-Control Methods

### Method: Based on Windows NT local or domain security Server: Microsoft INS

**Pros:** • Leverages your understanding of NT security. If you know how to set permissions on file-system folders, you know how to govern access to newsgroups.

• Leverages the existing user/group database. If you've already populated a domain database, you can reuse those names when configuring NNTP security.

**Cons:** • Works only on NT.

• Every NNTP user needs an NT domain account. Not a problem for your staff, usually. But if you park an NNTP server on the Internet so that your staff can collaborate with the outside world, you'll have to create one or more accounts for these outside users. That's scary.

• Access schemes are tied to file systems. If you want to migrate conferences from one NT box to another, you have to migrate a file-system subtree and all its associated permissions. If you want to temporarily disable authentication, you're stuck. Recursively granting full access to everyone is a one-way transformation from which you cannot easily recover.

### Method: Based on local or remote LDAP database Server: Netscape Collabra

**Pros:** • Works on all Netscape-supported OSes.

• Doesn't export OS accounts to Internet users.

• Supports client authentication. If you specify a mapping between a field of a client certificate (e.g., Common Name) and an LDAP attribute (e.g., user name), you can dispense with user-name/password log-ins and control access entirely by means of certificates.

**Cons:** • You have to learn how to use the local LDAP database bundled with Netscape servers or else acquire, install, and learn how to use a Netscape or third-party directory server.

• You have to populate the LDAP directory; there's no migration tool for capturing existing OS-based accounts.

*virtual.vpn* and put copies of the found articles in that virtual newsgroup. What's more, as new messages matching the *vpn* search flow into any of our private conferences, they are also automatically routed into *virtual.vpn*!

Nifty as virtual newsgroups are, I'm still left wanting a more powerful way to categorize newsgroups. Specifically, I'd like to be able to declare custom headers for a given group—in our contacts group, for example, these might be Company, Product, and Lastname—and then have the newsreader build sorted views based on those headers. I think this scheme won't even require any modifications to the NNTP protocol. News messages, like mail messages, are already full of custom headers, such as X-Mozilla-Status. Why not X-Company and X-Product? The server won't mind these extra headers; the client can make excellent use of them.

The latest news servers are works in progress. What's encouraging, though, is that they *are* progressing. NNTP technology was for years a diamond in the rough.

The standard INND already did more than most people realize. INS and Collabra have staked out important new territory. I can't wait to see what's next, but in the meantime I'm building some slick collaborative solutions around what's here today. ■

*Jon Udell is BYTE's executive editor for new media. You can reach him by sending e-mail to [jon\\_u@dev5.byte.com](mailto:jon_u@dev5.byte.com).*

# Javatalk



## Rebuilt Parts

*Parts for Java delivers an excellent visual-programming environment for Java.*

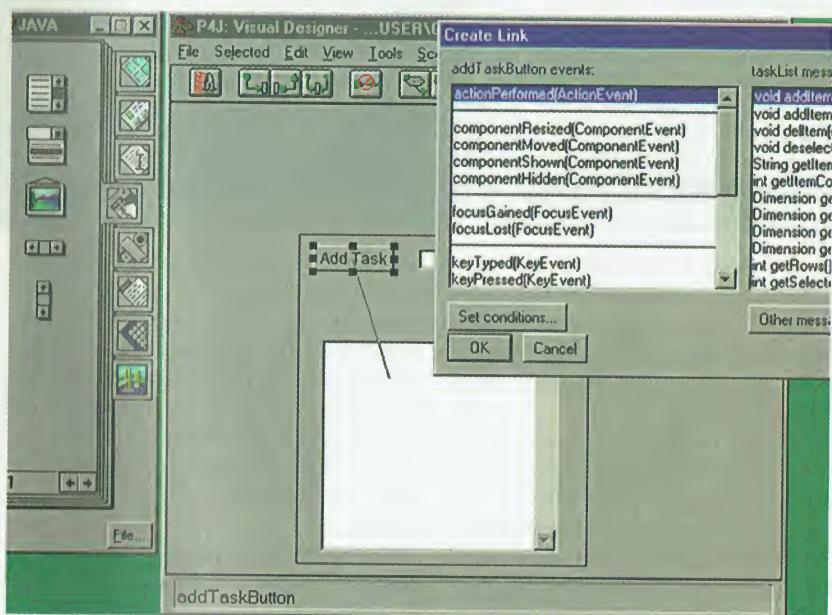
Well known for its Smalltalk-based products, ParcPlace-Digitalk (via its ObjectShare division) has released Parts for Java (PFJ). This is an integrated development environment (IDE) for Java development that inherits much from its Smalltalk parentage. The migration of the part concept, PFJ's atomic component, from Smalltalk to Java has been made possible largely thanks to the ongoing maturing of the Java bean. A PFJ part is a bean.

As the Java Development Kit's (JDK) beans definition has solidified and support for beans in the Java community has improved, "bean mechanics" have become more and more sophisticated. A growing number of Java development systems incorporate robust bean support; such is the case with PFJ.

PFJ's parts are the visual and nonvisual objects that populate a PFJ application (or applet). You create a Java application by the now-familiar activity of dragging and dropping parts into a Java application's frame.

Once a part (which is really a bean) is in place, you modify its characteristics through property sheets—dialog boxes that are packaged with the part (rather than being part of the IDE) and that provide access to a part's characteristics (such as its color or font).

Ordinarily, you access a part's property sheet by double-clicking on the part. PFJ improves on the bare-bones property sheet dialog box by adding a drop-down listbox (within each property sheet dialog box) that provides quick access to other parts in the application. This allows you to rapidly move from one part to another in the application; you don't have to close the dialog box and then click



**PFJ's create link dialog box shows available events and compatible receiving methods.**

on the next part to open the new property sheet dialog box.

### Programming with Wires

I've seen many implementations of visual programming by means of wiring together on-screen objects, such as buttons or scroll bars. IBM's Visual Age for Java was my most recent encounter with an IDE that used this paradigm. (In fact, Visual Age also used parts as the fundamental visual-programming component.) PFJ demonstrates what I think is—so far, at least—the best visual-programming environment of this sort for Java.

For example, suppose you want to establish a relationship between one part that is an event source and another that is the recipient of (and will respond to)

that event. If you right-click on the source part and drag to the destination part, PFJ opens a dialog box showing the events provided by the source and the responding methods offered by the destination. Select the event and receiving method, and PFJ will deposit the correct source code in your application's .java files.

Simultaneously, PFJ draws a connecting line between source and destination parts, and displays floating text boxes that carry the prototypes of the source event and recipient method. PFJ inserts placeholders in the latter's argument list; each placeholder consists of the corresponding object's data type and a solid-color diamond. (The diamond is replaced with the actual argument once you complete the definition of the method call.) If

## Java Gets Personal

It's no secret that Sun's vision is for Java to become a truly cross-platform language. It is perhaps more accurate to say that Sun hopes Java will become a *pan-platform* language; that is, not only the language for desktop systems but for nondesktop systems as well. And to that end, JavaSoft is sculpting a series of Java APIs that will be aimed at varied levels of functionality.

JavaSoft recently released the version 1.0 draft specification for the PersonalJava API. This draft is available on the JavaSoft Web site (<http://www.javasoft.com>) for a special 60-day period, during which time Sun will accept public comments on the specification

and possibly rerelease modified versions of the draft as it incorporates worthwhile comments.

PersonalJava's targets are personal consumer devices that make heavy use of communications. The specification suggests set-top boxes and intelligent telephones as potential candidate applications. Of necessity then, an implementation of the PersonalJava API will occupy a smaller footprint than an implementation of the full Java Development Kit (JDK) 1.1. (JavaSoft estimates that the PersonalJava virtual machine and supporting class libraries will fit in 2 MB of ROM and approximately 1 to 2 MB of RAM.)

The PersonalJava API is sort

of a subset of the full JDK 1.1 API. I say "sort of" because, though most of the PersonalJava API is indeed a simple reduction of the JDK 1.1 API, you won't find some new elements of PersonalJava in JDK 1.1.

For example, PersonalJava defines new Timer and TimerSpec APIs, which let PersonalJava applications create objects that provide what amounts to a millisecond-resolution alarm clock. You can attach a kind of "interrupt handler" to a timer, in much the same way that you attach a listener object to an event source in the JDK 1.1's event handler.

In addition, PersonalJava extends the Abstract Windowing

Toolkit (AWT) with new APIs for handling such things as display output double buffering and mouseless input. (Double-buffered systems provide an external buffer memory into which all the drawing is done. The updated display is shown on-screen by copying buffer memory to the actual screen's memory. This reduces unsightly side effects that can occur while the application and display hardware are battling for screen-memory access.)

Most interesting are the goals of the PersonalJava API. Specifically, that products "...based on PersonalJava should be usable by people with no computer experience." We'll see.

a link is incomplete—perhaps you haven't specified arguments needed in the receiving method—it glows red. (If you're building a complex user interface, this helps you quickly spot portions of the application that are unfinished.)

PFJ handles complex event/target relationships easily. That is, although an event implies a source part, which generates an event, and a target part, which responds to that event, the relationship can be more elaborate than that. For example, the target might call a third part to supply an argument for the target method. Just as you can wire the source and target together, you can connect a part to an argument in the target's method. That's where the placeholders come into play. They act as anchors for the connection between part and argument.

So, suppose that in response to a button-click event, a listbox copies the contents of a text box into the list. You can create a link between the text box and the method called in the listbox by right-clicking on and dragging between the placeholder I mentioned earlier and the text box. The IDE will open a dialog box showing available "getter" methods in the text box part for retrieving the text box's current string. When you select the proper getter method, PFJ does the coding for you.

### Compliant with JDK 1.1.2

PFJ supports the JDK 1.1.2's delegation event model. This makes it among the first

IDEs that I've seen with explicit support for the delegation event model, though more JDK 1.1.2-compliant IDEs will probably be available by the time you read this. Now, instead of PFJ generating an explicit source code event loop for managing event/target links, it simply generates a method call that registers the destination part as an "action listener" to the source part.

The source code that PFJ generates is deceptively simple. This simplicity is due partially to the delegation event model (and the consequent lack of an event loop). It's also due partially to the implementation of parts as beans. This latter fact means that a part's behavior is encapsulated in the bean and never appears in the source code that PFJ automatically generates. Nevertheless, because so much behavior is abstracted into the parts, the mechanics of the generated code are quite easy to comprehend.

### Good Parts

Beyond the IDE, PFJ also includes support for Common Object Request Broker Architecture (CORBA) and remote method invocation (RMI). On the CORBA

side, PFJ arrives with a trial version of Iona's OrbixWeb (which supports IIOP). On the RMI side, PFJ's RMI wizard guides you through setting up both sides of a remote method call.

PFJ's ClassMaster browser is its most obvious inheritance from the Smalltalk world. A classic three-pane browser, ClassMaster provides a unified view of a given class. That is, it will show you not only methods defined within the class, it will also show you any methods that the class inherits from its superclass in a single view. In that way, you can quickly get a picture of a class's total functionality.

Finally, PFJ's debugger, which is multithreaded and as good as any that I have seen, is written entirely in Java. That makes it portable to any platform that supports Java.

Although I haven't tried it yet, this portability should allow you to tackle those situations where an application runs well on one platform but fails on another (yes, this sometimes happens with Java applets). You can move the debugger wherever you need it.

Parts for Java is available from ObjectShare for a price of \$149. You can purchase it at the following Web site: <http://www.objectshare.com>. ■

### WHERE TO FIND

ObjectShare  
Sunnyvale, CA  
408-720-7585  
<http://www.objectshare.com>

Rick Grehan is a senior editor at Computer Design magazine and coauthor of *The Client/Server Toolkit* (NobleNet, 1996). You can reach him at [rickg@pennwell.com](mailto:rickg@pennwell.com).

# HMM...<sup>TM</sup>

ARTMEDIA'S 20" MONITOR EARNS A SPOT ON 1997 WINLIST.



OUR CANINE FRIEND WON'T BE THE ONLY ONE SURPRISED BY WHAT THEY SEE ON AN ARTMEDIA MONITOR. CAD OPERATORS AND GRAPHIC DESIGNERS WILL APPRECIATE OUR SHARPER RESOLUTION, BETTER FOCUS, LOWER DISTORTION AND HIGHER BRIGHTNESS. BASICALLY A GREAT PICTURE. WHICH MIGHT EXPLAIN WHY THE EDITORS OF WINDOWS

MAGAZINE PLACED OUR 20" GT-960T MONITOR ON THEIR PRESTIGIOUS 1997 WINLIST. IT ALSO MIGHT HAVE HELPED THAT THE GT-960T COMES WITH ADVANCED TRINITRON® TECHNOLOGY, A FLATTER SCREEN AND SUPERFINE PITCH. SO IF YOU WANT THE BEST PROFESSIONAL MONITORS AROUND, TAKE A LOOK AT WHO THE EXPERTS ARE PICKING.



**trismedia**  
WHERE REALITY IS TRUE



ARTMEDIA USA 2272 CALLE DEL MUNDO, SANTA CLARA, CA 95054, USA TEL: 1-408-980-8988 TOLL-FREE: 1-800-927-8633 FAX: 1-408-980-8999 [HTTP://WWW.ARTMEDIA.COM](http://WWW.ARTMEDIA.COM)  
PACIFIC TECHNOLOGY CO., LTD. 7F, NO. 285, CHUNG HSIAO E. RD., SEC. 4, TAIPEI, TAIWAN, R.O.C. TEL: 886-2-778-5850 FAX: 886-2-741-9521 [HTTP://WWW.PTC.COM.TW](http://WWW.PTC.COM.TW)

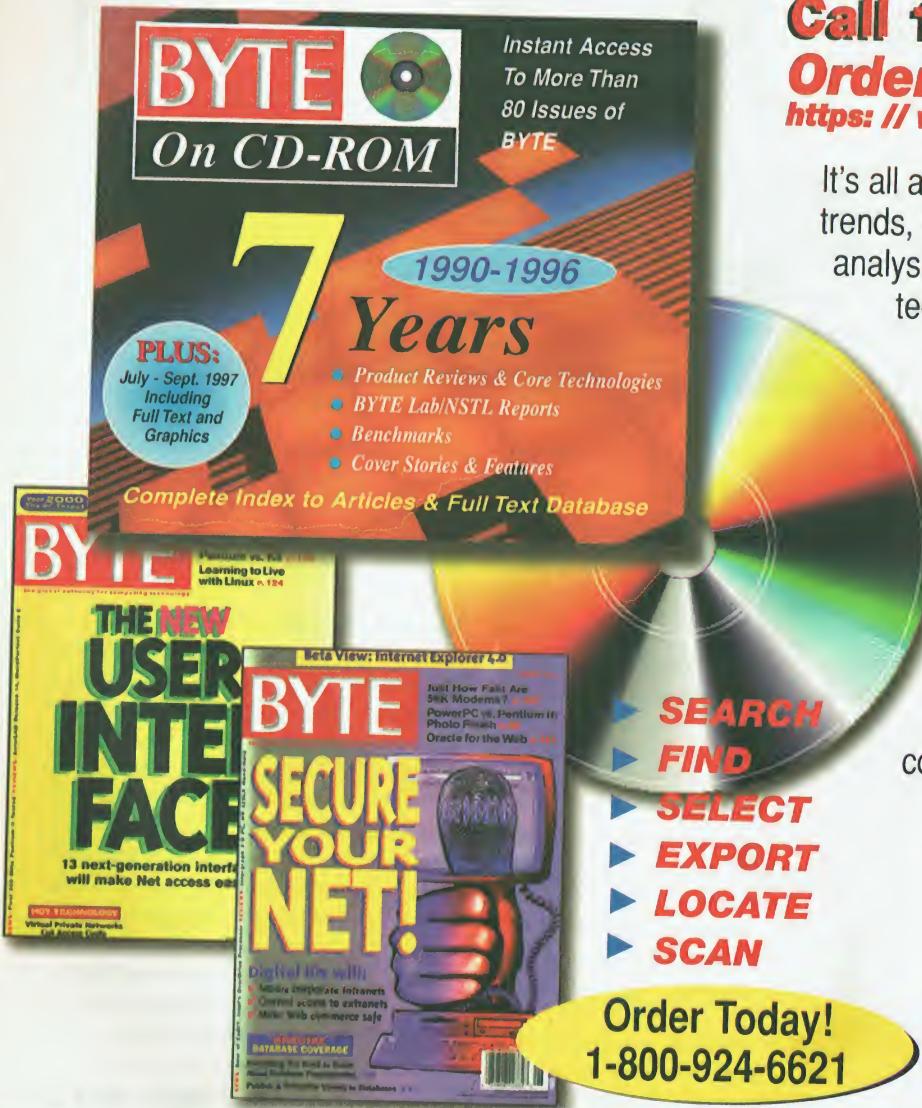
TRINITRON® IS A REGISTERED TRADEMARK OF SONY CORP. ARTMEDIA® IS A REGISTERED TRADEMARK OF PACIFIC TECHNOLOGY CO., LTD.

Circle 134 on Inquiry Card (RESELLERS: 135).

The Definitive Reference Source!

# BYTE on CD-ROM

Seven Years of BYTE—1990-1996  
Plus, Quarterly Updates with Every Issue in 1997



**Call 1-800-924-6621 or  
Order via the Web at  
<https://www.byte.com/orders/subcd.htm>**

It's all at your fingertips — emerging trends, comprehensive world-wide industry analysis, multiplatform coverage of all the technologies, in-depth testing and product evaluations, advice, tips, expert opinions, and much more!

It's a deal for anyone who's evaluating the significance of new technologies...doing research...making complex multi platform purchasing decisions...developing the next generation hardware or software products...preparing corporate plans.

- ▶ **SEARCH**
- ▶ **FIND**
- ▶ **SELECT**
- ▶ **EXPORT**
- ▶ **LOCATE**
- ▶ **SCAN**

Order Today!  
1-800-924-6621

**It's Comprehensive...  
Time Saving...and  
Easy to Use! It's all in  
BYTE on CD-ROM.**

Available for Windows 3.1, NT, Win 95.

## Order Now!

Toll-free International Numbers:

Belgium	080071635
Germany	0130826112
U.K.	0800973017
Italy	167876155
France	05916088
Netherlands	060222146
Switzerland	1557257
Denmark	80017728
Sweden	020791136
Other	
Int'l	091-752792
U.S./Canada	1-800-924-6621
FAX	609-426-5434

**YES! I want the power and convenience of BYTE on CD-ROM.**

Send me BYTE on CD-ROM **PLUS!** Full text from 1990-1996 issues of BYTE plus quarterly CD-ROM updates with full text and colorful

graphics for all the 1997 issues of BYTE for just **\$54.95**.

Send me BYTE on CD-ROM! Full text from 1990-1996 issues of BYTE—more than 80 issues for only **\$39.95**.

Charge my:  Master Card  VISA  Amex  Check enclosed (Payable to BYTE magazine, US funds only)

Card # \_\_\_\_\_ Exp. Date \_\_\_\_\_ Signature \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State/Province/Country \_\_\_\_\_ Zip/Postal Code \_\_\_\_\_

E-mail Address \_\_\_\_\_

Mail to: BYTE on CD-ROM, P.O. BOX 526, Hightstown, NJ 08530

Canadian and U.S. orders, please add \$2.95 for shipping and handling, and state tax where applicable. (Canadian orders add appropriate GST). Outside North America, add \$5.00 for air mail delivery. Allow 6-8 weeks for delivery.

A Division of The McGraw-Hill Companies

**Increase Speed And Efficiency With These Key Programming Resources...**

**TAKE 4 Books FOR ONLY \$4.95**

*when you join the Computer Professionals Book Society®*



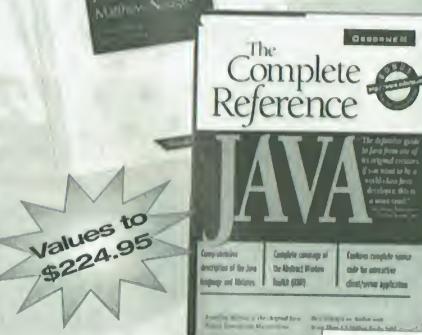
9126405 \$54.95



0203598 \$65.00  
Counts as 2



0464618 \$49.50



Values to  
\$224.95

8822319 \$39.95



0521344 \$40.00



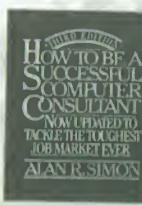
1575472 \$29.95  
Softcover



8819512 \$34.95



0571996 \$60.00



0576173 \$30.00



9119549 \$39.95



8821231 \$34.95  
Softcover



8821657 \$34.95



882138X \$32.95  
Softcover



9121101 \$44.95



8821428 \$29.95  
Softcover



8821304 \$39.95



8820901 \$27.95  
Softcover



9119549 \$39.95



0213895 \$55.00



8821991 \$27.95  
Softcover



0632952 \$55.00



8822009 \$29.95



5877740 \$39.95



8822092 \$34.95



0549486 \$39.95

**Take Advantage of These Great Club Benefits When You Join Today...**

**Savings** of up to 50% off the regular publishers' prices.

**Selection...** Every 3-4 weeks you'll receive the Club Bulletin featuring exciting offers on all the latest books.

**Convenience...** The Main Selection will be shipped automatically. If you want another book, or no book at all, return the reply form by the date specified. You'll have at least 10 days to decide. If you ever receive a book you don't want due to late delivery of the bulletin, you can return it at our expense.

And you'll be eligible for **FREE BOOKS** through the Bonus Book Program. Purchase just 2 more books during the next 12 months, after which you may cancel your membership at any time.

A shipping/handling charge and sales tax will be added to all orders. All books are hardcover unless otherwise noted. Publishers' Prices Shown © 1997 CPBS



A Division of The McGraw-Hill Companies



If card is missing, write to: Computer Professionals' Book Society®  
A Division of The McGraw-Hill Companies  
P.O. Box 549, Blacklick, OH 43004-9918

PHONE: 1-614-759-3666 (8:30 a.m. to 5:00 p.m. EST Monday-Friday)

FAX: 1-614-759-3749 (24 hours a day, 7 days a week)

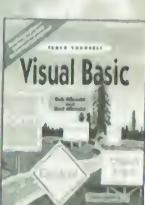
BYP1097



8823498 \$34.99



036432X \$29.95



8820782 \$24.95



0676208 \$34.95



8821495 \$29.95



0632634 \$79.50  
Counts as 2

## The Object Is to Manage Data

**D**ata used to be neatly constrained into fixed-width fields of numbers and characters. We organized it with flat-file databases, navigated it with hierarchical pointer-based systems, and linked it with relational tables—connected by keys and indexes and programmed using so-called fourth-generation languages (4GLs), which were usually proprietary and different for each DBMS and each vendor.

But today's data is more diverse and more complicated and comes in much larger quantities than just a couple of years ago. Now we need to organize and query audio, video, animated 3-D graphics and textures, compound documents, geographic information, and ever more data types. We need to have large-scale data storage and retrieval across global networks on demand. To meet all these new challenges, the best answer, though not the easiest, seems to be represented by object-oriented database management systems (ODBMSes).

ODBMSes are not trivial packages. They're complex and expensive, and using them requires a change in procedures, habits, even attitude. But more and more organizations are choosing ODBMSes to help them do the jobs they need to get done. Some reasons include the growing presence of object-oriented programming models in the client/server realm, including COM, DCOM, and CORBA; the inability of traditional, SQL-based, relational database management systems (RDBMSes) to address complex data and multitiered architectures; and the semantic mismatch between SQL and more modern, com-

ponent-based languages, such as Java, ActiveX, and C++.

For this report, BYTE looked at three of the major players: Object Design's ObjectStore, O2 Technology's ODMG, and Versant Object Technology's Versant. Each represents a somewhat different approach to building an ODBMS, but all are compliant with the Object Desktop Management Group (ODMG) standards. All are available for both Unix and Windows NT platforms, and all include full support for C++ and

*When you're tracking large, complex data types, you need an object database management system like one of these three.*

*By Todd Zino*

forward task. We were unable to create useful and comparable tests in the time that we had available (see "Missing the [Bench] Mark" on page 126).

### I Object to This Relationship

Before getting into the specific products, let's review how ODBMSes differ from RDBMSes. The relational database model was built on the concepts of algebraic set theory, monolithic lookup tables, and a simple ad hoc query grammar, which was eventually standardized into the omnipresent SQL.

ODBMSes, in contrast, are centered around the concepts of persistent storage in object-oriented programming (OOP) languages. In essence, this means that classes, attributes, and instances of objects can be represented within a database in the same way that they're represented in OOP languages. Also, they can be stored and retrieved by applications as needed in their natural form without needing to be altered to fit into a relational table.

While the pure, theoretical RDBMS model is versatile enough to accommodate any object type, data structure, or distributed architecture, when it comes to practical implementations and real-time performance issues, the relational model starts breaking down and becoming less than optimal. Why? Because most modern client/server and other complex software packages are programmed in terms of objects, and objects just don't fit neatly into relational tables. More often than not, the only solution for this problem is to create a separate table for each distinct class that exists in the particular

### BYTE BEST

OBJECT-DATABASE SYSTEMS

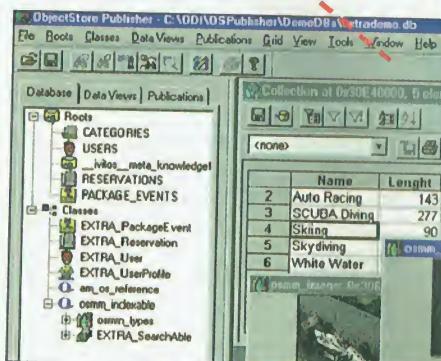
**Object Design's ObjectStore**  
was a standout in tough competition,  
offering a strong architecture and  
effective development tools.

have either beta or shipping interfaces for Java.

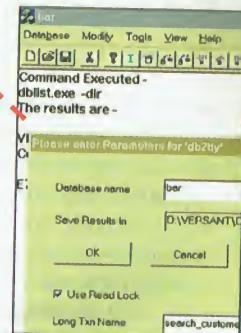
We installed these products on NT-based servers and exercised their capabilities, seeing what they were individually best suited for and evaluating the support available to the user and the network administrator. In our evaluations, we placed considerable emphasis on the ease of development and deployment, since these products are merely building blocks that you have to put together as efficiently as possible. We noted how well they serve up data for Web- and Internet-based applications, and what use they made of Java.

Our original plan included extensive performance testing, but we learned the hard way that this wasn't such a straight-

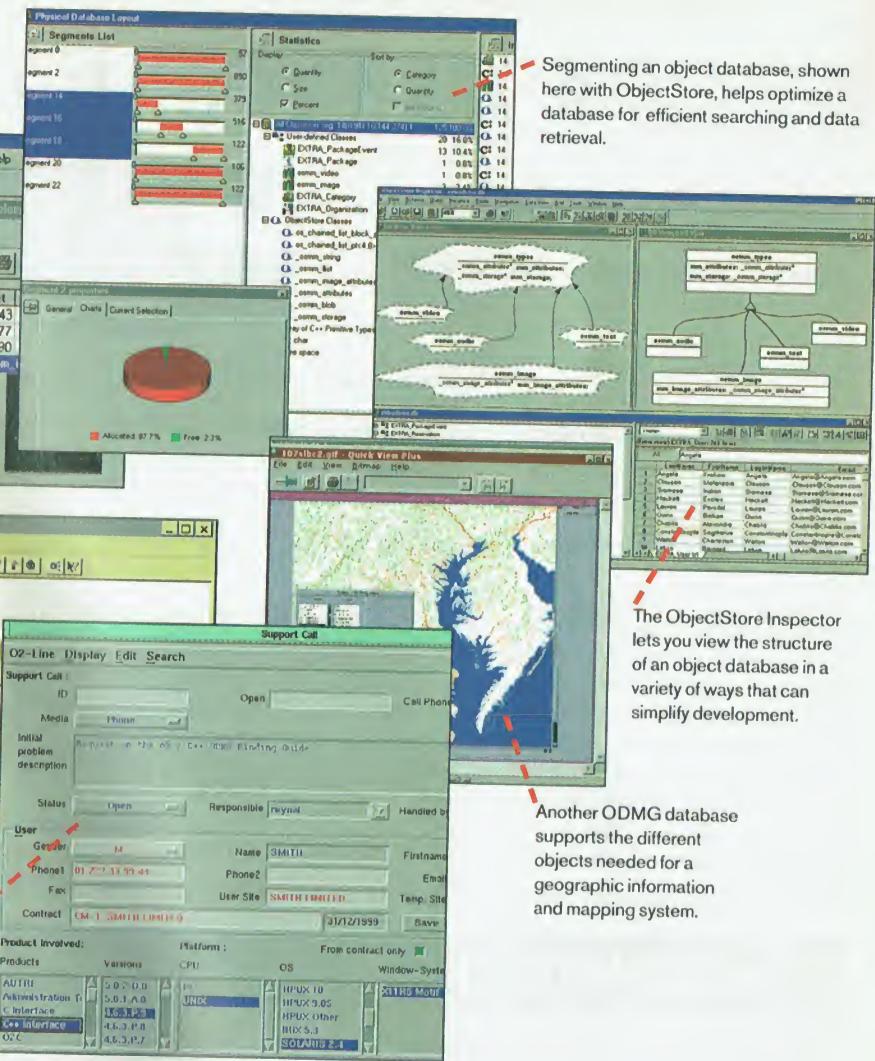
ObjectStore's Publisher makes it easy to view and organize object data.



Versant lacked all but a rudimentary administrative GUI and was basically command driven and C++ programmed. That's fine for some organizations, less helpful for others.



This screen is part of a user-support system developed with ODMG, showing its ability to handle differently structured objects.



## To manage data objects of all types requires some programming, but most ODBMSes also provide helpful GUIs.

database model that's being developed. Unfortunately, once you have a number of classes, you need to take data from many tables to complete most queries, and the overhead becomes significant. Doing a SQL JOIN to pool data from multiple tables can involve intensive algebraic computations when you're working with large amounts of data. The more complex, hierarchical, or interrelated object-oriented data becomes, the harder it is to coerce the relationships into rows and columns, and it becomes ever harder to read and update such data.

Object databases remove this layer of complexity and theoretical discrepancy, and, in fact, their architecture lends itself more readily to distributed computing and local caching than does the RDBMS model. It's often said that ODBMSes exhibit ter-

rible performance on simple queries and don't support ad hoc queries. Indeed, straight queries in a relational database that only require pulling data from one table and a few columns might run faster than an equivalent ODBMS transaction. However, the latter have been observed to perform from 100 to 1000 times faster on complex queries where RDBMSes required a JOIN. (For more on the advantages and strengths of ODBMSes, see "Debunking Object-Database Myths" on page 101.)

## The Development Process

While ODBMS products have proven their reliability at the enterprise level, they have yet to reach that maturity on the interface and development side. When developing a data model in an ODBMS, you must come to terms with many different data

structures. Some of these constructs—array, set, cursor (a pointer used to scan through a grouping of objects), or bag—are familiar to the seasoned programmer and are also used in RDBMS development. Others are unique to ODBMSes and are useful for optimizing performance.

For instance, a *segment* is loosely defined as a physical grouping of objects as a unit of a larger database. It's useful when you have objects with a few large attributes (e.g., an employee object with an associated binary image). If you group the larger attributes of different objects together in a segment, the system can scan both large and small objects faster—the large ones because they're all in the same physical location in storage, and the small ones because the size of each object in storage has decreased.

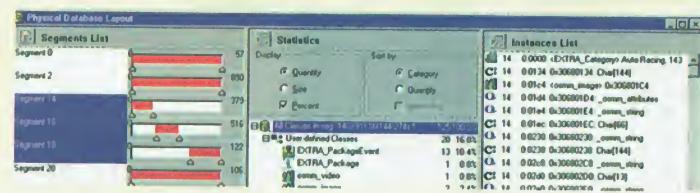
*continued*

# LAB RATING RESULTS

## BEST OVERALL

### Object Design's ObjectStore

A very well thought-out and easy-to-use interface and a rich feature set make this package a standout.



	PRICE (WINDOWS NT/UNIX)	WEB INTERFACE (PRICE)	TECHNOLOGY	FEATURES	USABILITY (EASE OF DEVELOPMENT)	OVERALL SCORE
<b>ObjectStore 5.0</b>	<b>\$3300 / \$6000</b>	<b>ObjectForms (\$3200)</b>	★★★★	★★★★★	★★★★★	★★★★★
ODMG 5.0	\$4000 / \$6000	O2Web (\$5000)	★★★★	★★★★	★★★	★★★★
Versant 5.0	\$5500 / \$9000	VersantWeb (\$995)	★★★★	★★★	★★★★	★★★★
★★★★★ Outstanding	★★★★ Very Good	★★ Good	★ Fair	★ Poor		

Vaguely similar is the cluster concept, another way to group like objects or attributes strategically. Clusters work more at the logical level, placing certain objects with stronger interrelations (for example, children in a tree) closer together. Each of the tested ODBMSes has these constructs in some form, although they're certainly not interchangeable. To some extent, a lot of these optimizations are auto-

mated implicitly upon the creation and population of a database (particularly in Versant). But to gain the finest control, especially for mission-critical applications, you must define them explicitly.

### Versatile Versant 5.0

Versant gears itself toward the higher-end enterprise market, with emphasis on transaction granularity and fault-tolerance. De-

spite its strengths in these areas, it's quite lacking in development aids, and its user interface is primitive.

Unlike many commercial ODBMSes, Versant is based on the object-server model, not the page-server implementation found in ObjectStore (O2's ODMG, meanwhile, uses a hybrid). With a page server, the smallest unit of data is of a fixed size (usually about 4 KB), while an object server deals with logical objects, which are often smaller. When objects are small, this object-server architecture permits a maximum of concurrency for servers with a heavy transaction load.

Versant offers a fault-tolerant server, with industry-leading solutions for synchronous database replication and transparent master/slave mirroring. These features are deeply rooted in the ODBMS architecture, thus requiring a minimum of code-grappling to configure.

Versant Web, a companion product aimed specifically at Web applications, is relatively less expensive than its two competitors while still offering vital functionality and interoperability with all major Web-server APIs.

Although Versant excels in versatility and reliability, it fails badly in terms of ease of learning and administration. The C++ API was easily the most complicated of the three we tested, and it also had perhaps the least readable documentation and reference. The graphical tools are restricted to a simple DBAdmin utility, which offers little beyond the most basic database-administration operations. And there are no RAD tools available.

We didn't test Versant's Java interface, which hadn't yet been released, but it's

## The ODBMS Desktop

A key advantage of ODBMS technology is its ability to scale down to the desktop as well as up to the enterprise. The technology has many potential uses in software engineering, graphic design, and the development of applications that manage data.

Most software today requires some way to store and retrieve local data. Because the basic interfaces for this in C++ and Java, for example, are slow and unreliable, some type of database technology must be implemented and embedded into the product. But in these cases, a full-fledged database server, object or relational, would be expensive, excessive, and impractical. Instead, products such as NeoLogic's NeoAccess and Object Design's PSE Pro cater to a new paradigm known as "databases for the desktop."

NeoAccess 5.0 can be used as a storage back end within any C++ application framework. Because there's no additional licensing-fee structure, the NeoAccess back end can be integrated into commercial products without raising the issue of per-seat or per-copy royalties. The product supports popular C++ compilers and development environments on Windows, Unix, Mac, and BeOS platforms.

The NeoAccess technology is a component of many of today's popular software titles, including NetObjects Fusion (a Web-page editor), Netscape Communicator, and Corel's productivity software. No Java interface is yet available.

With PSE Pro, Object Design offers the core technology on which its larger enterprise system is built. PSE (which stands for Persistent Storage Engine) uses the same storage technology found in ObjectStore, but without the large memory footprint or multiuser architecture. PSE Pro provides a system of libraries and schemata that allow for the efficient and reliable serialization of data handled in an application.

Currently, PSE Pro has interfaces for Java, C++, and ActiveX. Object Design's implementation of ODBMS classes for Java has been an influential basis for the ODMG's upcoming standard for using object-database technology with Java. PSE Pro comes with a less-functional PSE product that can also be freely downloaded from Object Design's Web site.

reported to have all the functionality of Versant's standard C/C++ interface. We think it will probably provide an easier development environment.

## Who's Minding the ObjectStore?

BYTE has already looked at Object Design's ObjectStore 5.0, a cutting-edge ODBMS that offers the best-case scenarios for development, architecture, and rapid time to market (see "What's in Store for the Web," August BYTE). ObjectStore is fundamentally different from the other two products, using virtual memory mapping rather than inheritance and unique IDs to regulate and manage each object.

Where Versant and ODMG require each newly created object to be a subclass of the generic base object class, ObjectStore does not. This saves an average of 64 bytes per object of overhead, a small gain that really adds up for enormous multigigabyte databases.

In addition, ObjectStore is the only ODBMS we tested that offers ActiveX support, clearly a big advantage for Windows NT distributed development. Perhaps the most impressive feature of ObjectStore is its suite of visual tools for developing applications and administering existing databases. Inspector 2.2 is an advanced utility that allowed us to edit data, rearrange a database's physical organization, and design queries. All this is contained in a user-friendly point-and-click environment, which uses a familiar spreadsheet-like layout to display data. You can also evaluate and debug the often-complicated database schema file using Inspector.

Another useful tool in the ObjectStore arsenal is the Performance Expert, an analytical utility that examines an ObjectStore application or architecture and suggests optimizations, as well as giving detailed performance information.

With ObjectStore, you can develop in both C++ and Java, and your Java code can access C++ objects and methods within the database. In terms of its C++ API, ObjectStore sported the most streamlined code with the least amount of required structures, macros, and cryptic class instantiations to construct a simple database and object model. Unlike the other two products, however, there's no Smalltalk interface.

Object Design's support for ObjectStore is very impressive. It's standard practice for an engineer to spend a day or two

		Object-Database Systems Features		
		ObjectStore	ODMG	Versant
Version	5.0	5.0	5.0	5.0
Price per Unix development seat	\$6000	\$6000	\$9000	
Price per NT development seat	\$3300	\$4000	\$5500	
Web interface and price	ObjectForms (\$3200)	O2Web (\$5000)	VersantWeb (\$995)	
<b>PLATFORMS SUPPORTED</b>				
Windows NT	✓	✓	✓	✓
Windows 95	✓			✓
IBM OS/2				✓
Solaris SPARC	✓	✓	✓	✓
Digital Unix	✓	✓	✓	✓
SGI Irix	✓	✓	✓	✓
IBM AIX	✓	✓	✓	✓
HP-UX	✓	✓	✓	✓
SCO Unix		✓		
Solaris x86		✓		
SunOS 4.x		✓		
<b>DEVELOPMENT TOOLS</b>				
Visual development tools	Inspector, Performance Expert	O2Look, O2Tools (Unix only)		
Virtual administration tools	Inspector	O2Tools (Unix only)	DBA	
<b>LANGUAGES SUPPORTED</b>				
Java	Included	Optional*	Optional* (beta)	
C++	Included	Included	Included	
Smalltalk		Optional*	Optional*	
ActiveX	Included	N/A	N/A	
<b>ODMG COMPLIANCE</b>				
ODL (Object Design Language)		✓		
OQL (Object Query Language)		✓	Subset (VQL)	
SQL-92		✓	✓	
Object schema	Virtual mapping	Base class	Base class	
<b>ARCHITECTURE</b>				
Transaction architecture	Page server (physical)	Page server (physical)	Object server (logical)	
Server-based method execution	✓		✓	✓
Client-based method execution	✓	✓		✓

\* For Versant and ODMG, one language interface of choice comes with the development license. Additional language interfaces cost extra.

✓ = yes; N/A = not applicable.

★★★★ Outstanding    ★★★ Very Good    ★★★ Good    ★★ Fair    ★ Poor

with a customer to help install the product and resolve any questions.

## The French Connection

For reasons that escape us, a surprisingly large number of ODBMS products originate in France, including O2 Technology's ODMG 5.0. For the developer, the ODMG 5.0 database server presents two different faces. On one side is a competitively priced server for Unix platforms, offering O2Look and O2Tools, nice rapid ap-

plication development (RAD) tools, and graphical interfaces to its complex database system.

Alas, there's no visual interface whatsoever on the NT side of things. This is particularly unfortunate, given that a significant amount of advanced client/server development is performed on the Windows platform even when the target server might be a Unix machine.

On the positive side, O2 boasts the implementation of its own 4GL, called O2C,

## TECH FOCUS

## PERFORMANCE

## Missing the (Bench)Mark

To develop applications using a given ODBMS, you first have to learn its general architecture and application framework. No two products have the same characteristics, so preparing a benchmark to test performance requires developing a schema that will be representable across each vendor's ODBMS.

But that's the easy part. Each product has its own complex API, and some can be used with only a limited range of tools, such as C++, which itself is not fully standardized.

Each product tested for this review had entirely different C++ data structures to represent a basic object with string attributes of random length. Moreover, each product had its own C++ macros, which were needed to initialize the database, populate it with replicated objects, and begin and end a transaction. And, of course, these macros don't behave the same for each ODBMS product. For objects such as a database segment, a large pointer, a record cursor, and a static reference, there were often vastly different implementations of each for a given product. For these reasons and more, porting a generic pseudocode application with any degree of realistic complexity to each ODBMS could not guarantee a reasonable level of parity across these very different products.

Not only was the basic creation of databases and objects not consistent, the semantics of a transaction and the database's model of locks and privileges employed during a read or write were also inconsistent. To each vendor's credit, all the ODBMSes tested had a well-defined and highly flexible system of locks and transaction-behavior parameters. But, again, there was no easy way to equate a particular scheme that would be the same for each database. And while each

which allows for advanced and simplified programming and dynamic memory and object management within a syntax

and environment that are fully compatible with plain old ANSI C.

Furthermore, O2 Technology has been working with top CORBA developers to produce its own O2Corba add-on for ODMG 5.0, which gives a full interface to the popular CORBA implementation of distributed object architecture. In addition, O2 has recently developed a high-tech server model, called "adaptive locking," which permits a hybrid of page and object locking for concurrent transactions.

Objects stored in the O2 database are language neutral. This means that if a particular object is developed in Smalltalk, it can be accessed or manipulated by a Java application and vice versa.

## Good Support

One final word about deciding on a package like one of these: Help from the vendor when you need it is critical for enterprise software, including ODBMSes. All three products we tested offer outstanding support, which sometimes includes contract accounts and extensive on-site support and training. And this includes

product supports Object Query Language (OQL), that isn't always the best method for querying the database, and products allow you to not use OQL at all in performing reads and writes on the ODBMS.

Most of these benchmarking issues stem from the general complexity of databases. Even relational DBMSes tend to use proprietary language additions to maximize performance and efficiency in an enterprise application.

Thus, the bottom line is that NSTL could not, under any practical or realistic circumstances (and in the time available), obtain performance data with which to compare real-world implementations of the ODBMS products that are reviewed in this article. We concluded that to create tests that would fairly compare the three systems would require, at the very least, three separate development efforts, and even then we would have to make choices that would call some results into question. Ralph Waldo Emerson may have said that consistency is the hobgoblin of little minds, but BYTE simply can't make performance comparisons without it.

There's hope on the horizon, though. The ODMG has a better chance of working toward a Java common standard for the ODBMS world before vendors diverge in their various implementations of a Java API. If Java can be standardized here, its ease of development and strict object-oriented semantics relative to C++ will give it a good chance to become the premier language of choice for ODBMS development. Applications written in Java for a particular ODBMS are much more easily portable to another ODBMS than they are if they're written in C++. Moreover, Java melds very tightly with the ODBMS concepts—something SQL could never do. This will also be an important factor if ODBMSes are to gain widespread acceptance in the future of enterprise data handling.

not only technical support, but also a future commitment to compatibility and standardization.

The vendors have come a long way in developing better front ends in which existing SQL queries can be executed and traditional relational concepts ported to an object framework. It's good to know that when you have to switch, you can rely on good tools that build on what you already have. ■

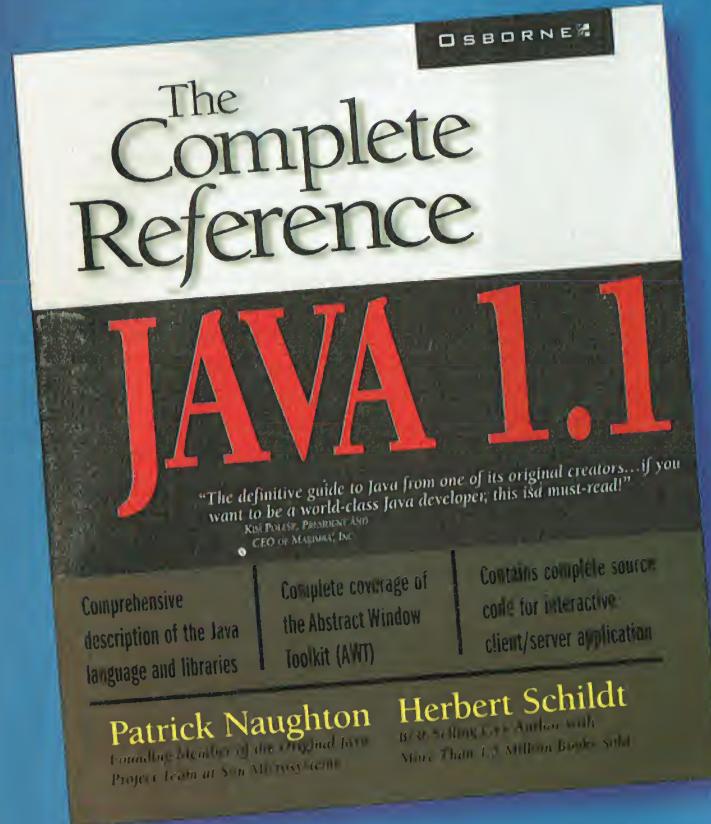
*Todd Zino evaluates software-development strategies, performance, and user interfaces for NSTL. You can contact him by sending e-mail to [Todd@lacemaker.com](mailto:Todd@lacemaker.com).*

*Evaluations in this report represent the judgment of BYTE editors, based in part on extensive tests conducted by NSTL, Inc., as documented in a recent issue of its monthly Software Digest. To purchase a copy of that report, with NSTL's own evaluations and data, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428; 610-941-9600; fax 610-941-9950; on the Internet, [editors@nsl.com](mailto:editors@nsl.com). For a subscription, call 800-257-9402. BYTE magazine and NSTL are both operating units of The McGraw-Hill Companies, Inc.*

# Programmer Companions

## Osborne delivers the complete story—

and the condensed bare-bone facts—on today's hottest programming languages



### Java 1.1: The Complete Reference, Second Edition

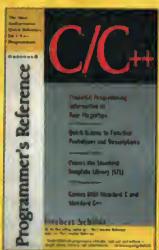
100% pure comprehensive Java references. From two of the biggest names in programming today.

Patrick Naughton and  
Herbert Schildt  
ISBN: 0-07-882436-2  
\$39.99 USA, \$57.95 CANADA



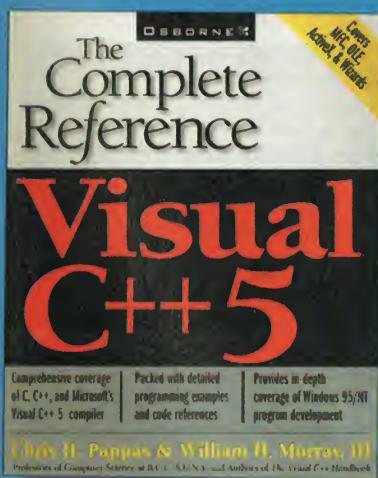
### Java Programmer's Reference

Herbert Schildt  
ISBN: 0-07-882368-4  
\$16.99 USA, \$24.95 CANADA



### C/C++ Programmer's Reference

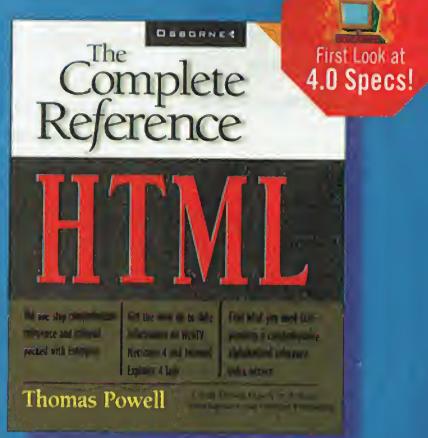
Herbert Schildt with Joe O'Neil  
ISBN: 0-07-882367-6  
\$16.99 USA, \$24.95 CANADA



### Visual C++ 5: The Complete Reference

Build the most powerful Internet and database applications possible with Visual C++ 5.

William H. Murray III and Chris H. Pappas  
ISBN: 0-07-882391-9  
\$39.99 USA, \$57.95 CANADA



### HTML: The Complete Reference

The all-in-one theory, tutorial, and reference resource for HTML programmers of any level.

Thomas Powell  
ISBN: 0-07-882397-8  
\$39.99 USA, \$57.95 CANADA  
Available: November 1997

AVAILABLE NOW at

**BORDERS**  
BOOKS • MUSIC • CAFE

At local book and computer stores, or call 1-800-262-4729

**OSBORNE**

REQUIRED READING for the Information Age  
<http://www.osborne.com>

### Webtronics WebBox

#### ADVANTAGES:

- + No moving parts equals high reliability
- + Highly extensible with Tcl programming to support serial-programmable devices and CGI scripting
- + Supports HTTP 1.1 keepalive parameter

#### DISADVANTAGES:

- Lacks HTML editor, requires some HTML design knowledge
- Lacks SCSI port for adding storage space and expandability

What gives WebBox its edge are its two programmable 115.2-Kbps serial ports. Using Tcl, a small scripting language from Sun, you can program its one serial device to do a variety of things. For example, you might turn the system into a monitoring device by hooking up a Connectix camera and programming it to upload data to a Web page at certain intervals. You can also write CGI scripts using Tcl, and sample code is available in the help section.

Webtronics has put some nice touches on the box, such as extensive link lights. These LEDs indicate network traffic, such as packet errors and collisions; the ones on the WebZerver and the Twister are not as detailed. Like the Twister, the WebBox allows for out-of-band management via its external serial port. But unlike the other two, the WebBox has no moving parts, which adds to its reliability. Instead of a hard drive, it uses 4 to 20 MB of flash ROM, in addition to 512 KB of ROM. Its memory consists of 4 MB of DRAM.

All three mini Web servers have password ability at all levels. The WebBox,

however, bests the others with a front-mounted switch that lets you set the system to "read only." I was also impressed by the depth of some of the other configuration features, like the ability to change the media access control (MAC) address by manually reinitializing the WebBox (i.e., erasing the flash memory) from another front-panel switch.

The one thing the WebBox lacks, however, is an HTML editor. Instead, you need to use a third-party HTML editor like FrontPage and import your premade pages, or know HTML and type in your own tags. To get my Web page up, I cut and pasted prefab HTML code into the WebBox's index.html directory.

Navigating the WebBox is easy. Its menus contain few graphic elements yet provide a lot of information. I found extensive help available on-line, including an operation FAQ, a problem-solving section, a reference manual, and sample code.

For the technically elite, WebBox is not only a fun toy but a quick and practical means of Web connectivity for a branch office or workgroup. It is scheduled to ship in late fall for \$1299.

### Microtest WebZerver

#### ADVANTAGES:

- + Highly expandable; allows seven read/write SCSI devices
- + Ships with group-discussion feature

#### DISADVANTAGES:

- Priciest of the bunch

The need for reduced administration and overhead and the desire to get on

the Web quickly and inexpensively don't always go hand in hand. Both Microtest's WebZerver and Compact Devices' Twister eliminate the complexities of a traditional Web server. They also are excellent tools for workgroups that want to post pages to a corporate intranet.

I found WebZerver at least as easy to implement as the WebBox. As soon as I attached it to a hub linked to a few PCs, WebZerver tried to get an IP address automatically, using Dynamic Host Configuration Protocol (DHCP), BootP (a TCP/IP protocol used to enable diskless PCs to find their own logical IP addresses at start-up), and Reverse Address Resolution Protocol (RARP). During setup I noticed Easy Site Layout, a utility that lets you choose different Web templates for different groups. Engineering, corporate, and human resources were among the choices. At press time, WebZerver didn't offer much in the way of automatically customizing those pages, however. Microtest officials say the unit will ship with a 30-day trial version of NetObjects' Fusion HTML editor.

At \$1595, WebZerver is the most pricey of the three. However, it's the only one with 10/100Base-T Ethernet support. This improves performance and extends the WebZerver's useful life as people move up to 100-Mbps networks. Its 133-MHz AMD 486 (P75-class) processor, 2.1-GB hard drive, and 8 MB of RAM make it the most powerfully configured system.

Because WebZerver was in early beta stage at press time, many of its capabilities, such as monitoring site activity and usage, creating users and groups, and backup and security functions, were not yet implemented. According to Microtest officials, when the product ships it will also allow seven read/write SCSI devices to connect to its SCSI port for further expandability.

Other features, like the Web page set-up wizard and the context-sensitive file search tool, were very useful. In the administration menu, there is a pointer to download a demo copy of WS FTP. I used this utility to transfer premade HTML files to the hard drive.

Though they were not available when I tested the WebZerver, EasyPrint (which converts documents to HTML) and EasyTalk (a newsgroup feature) utilities are expected to ship with the product.

WebZerver will work well in a small office or workgroup, especially for those people who don't want to bother with programming. In terms of sheer speed in

## TECH FOCUS

### HTTP 1.1 Improves Net Efficiency

All Web servers, even small ones, need to have HTTP embedded in their core OS in order to function. HTTP 1.0, which works in conjunction with the TCP protocol in the IP family, is used for packetizing Web information such as HTML documents and file downloads.

One advantage of HTTP 1.0 is that it is very bursty; it's great for handling multiple tasks and switching from one thing to the other. But there's always room for improvement. HTTP 1.1, a reworking of its predecessor, is designed to ease network congestion by reducing the number of connections required between client and server.

The keepalive function of HTTP 1.1 is an example of this improved efficiency between HTTP and TCP. TCP reaches full data transfer efficiency only when the connection between the client and the server is kept open. HTTP 1.0 closes that connection after each request. Keepalive keeps a route or "tunnel" open all the way through the network, allows persistent connections, and remains open for multiple requests. The benefit to the Web server is capacity; many documents can be accessed with one connection.



• The event where  
**enterprise computing**  
• is going.

**IBM is going. Cisco is going.** Now it's time you headed to the only marketplace that brings together the technologies that drive enterprise computing — Internet, intranets and extranets, server platforms, network infrastructure and application development. COMDEX/Enterprise will be the year's largest and most important event dedicated to delivering solutions for the professionals who develop, build and manage the enterprise — CIOs, line of business managers, system managers, corporate developers and network integrators — the decision makers who are setting corporate computing agendas and making the final call on enterprise-wide volume purchases.

• **COMDEX**  
**Enterprise**

**Developing, building and managing  
the applications that run today's enterprise.**

For information on exhibiting, call 617-433-1600 or e-mail [mccarty@comdex.com](mailto:mccarty@comdex.com)

For information on attending, go online at [www.enterprise.comdex.com](http://www.enterprise.comdex.com)

**West** March 23 — 27, 1998 • Moscone Center • San Francisco, CA

**East** April 5 — 9, 1998 • Hynes Convention Center • Boston, MA

including



Produced by SOFTBANK COMDEX Inc., the leading producer of worldwide information technology events.  
©1997 SOFTBANK COMDEX Inc. • 300 First Avenue, Needham, MA 02194-2722 USA EN98-1176 7/97

## Apple Power Mac 6500

This system has a 300-MHz 603e processor, a 50-MHz system bus, and 512 KB of L2 cache clocked at 50 MHz. Its 64 MB of RAM is expandable to 128 MB. For storage, it has a 4-GB hard drive, a 12X SCSI CD-ROM drive, and a 100-MB Iomega Zip drive. The communications slot has a 33.6-Kbps Express modem. The built-in video uses the ATI 3D Rage II+ graphics-acceleration chip.

The Power Mac 6500's other expansion features seem rather sparse, particularly since it's the most expensive of the three systems. It doesn't include an Ethernet interface or a second display board. It also sports the fewest PCI slots (two). However, adding a PCI expansion card is a snap: You undo three screws, pull on two tabs, and drag out the drawer that houses the slots. Then you simply plug in the card and slide the drawer back into the system.

## Umax SuperMac C600/280

This system has the slowest processor speed of the three, at 280 MHz. The processor sits on a plug-in board, which allows for future upgrades. The 280-MHz speed is partially offset by a 1-MB in-line cache that's clocked at 80 MHz, twice the system-bus speed. This also means that the SuperMac's system bus is the slowest of the trio, running at 40 MHz. In terms of BYTEMARK performance, the SuperMac C600 placed last in integer computations, but it actually edged out the faster systems on floating-point computations.

At \$2395, it comes loaded with a 12X CD-ROM drive, a 4-GB hard drive, 32 MB of RAM (expandable to 144 MB), an Asante 10Base-T Ethernet card, a second display board with accelerated 2-D and 3-D graphics for dual-monitor support, and a 33.6-Kbps Global Village fax/modem card in the communications slot. It also has a slew of extras, such as a pair of miniature stereo speakers and a JABRA Ear Phone for use with the telephony functions.

To add a PCI card to the SuperMac, you must first loosen some screws, slide

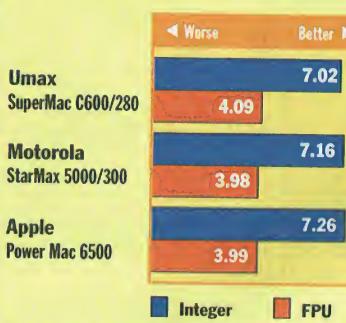
## TECH FOCUS

### Power Video

While Microsoft touts the Memphis OS's support for four monitors once it's released, for 10 years the Mac OS has supported up to six monitors. When the Mac II was introduced, Color QuickDraw, the Mac's imaging engine, was designed to support multiple monitors with different pixel depths and resolutions. When you plugged a NuBus video board into the system, the Slot Manager automatically fetched the board's driver and hardware characteristics from its firmware. The Slot Manager passed this information to Color QuickDraw. The user didn't do anything other than arrange how the monitors displayed the desktop. The limitation of six monitors was due to the number of NuBus slots in the Mac II.

For PCI Macs, an Expansion Manager obtains board information for Color QuickDraw. The different bus interface necessitates this new Manager. Open Firmware obtains the board's driver, initializes it, and passes board characteristics back to the Mac OS. As before, no user intervention is necessary: You simply plug in the board and start the system. You use the Monitors and Sound Control Panel to arrange the orientation of the monitor screens.

### BYTEMARK Indexes



Note: Results obtained using Motorola Developer release 3.

the case off, and remove a support strut. I managed to figure this out without consulting a manual, but the process could be daunting for some people. MPEG playback of the video CD didn't work, but a quick download of a patch from the SuperMac Web site solved the problem. The system doesn't come with a Zip drive, but there are plenty of bays for one.

## Motorola StarMax 5000/300

On the outside, this box looks almost as smart as the Apple unit. There's a lot to like on the inside, too: a 300-MHz 603e processor, 512 KB of L2 cache (expandable to 1 MB) on a 50-MHz bus, 32 MB of RAM

(expandable to 160 MB), ATI 3D Rage II+ accelerated graphics for the built-in video, a 16X CD-ROM drive, a 4.3-GB hard drive, 10Base-T Ethernet, an IMS Twin Turbo graphics card for dual-monitor support, and an internal 100-MB Zip drive—all for a price of \$2899.

While the StarMax placed last in both the BYTEMARK integer and floating-point calculations, the difference among the three systems was so small that it was unnoticeable. With the unit's Ethernet interface, accelerated graphics, and large hard drive, I found myself using it a lot.

The one dark side to the StarMax is adding a PCI card. Of the three systems, this was the hardest to do this on. I had to consult the manual to figure it out. And the procedure involves some disassembly—again, a bad thing for the average user.

## A Close Race

Of the three systems, I prefer the StarMax because it's well built and about as fast as the other two. The mix of extras, such as the Ethernet interface, Zip drive, and second display card, make it attractive. Plus, it has no problems with MPEG playback. In addition, the Tanzania II design means that you can use a spare PC mouse and keyboard on the system.

The SuperMac C600 places a close second, with nearly the same goodies and a price of just under \$2400. Despite its good performance, the Power Mac's high price and lack of a second display and Ethernet interface means I can't recommend it over the Motorola and Umax systems. **B**

Tom Thompson is a BYTE senior technical editor at large. You can reach him by sending e-mail to [tom\\_thompson@bix.com](mailto:tom_thompson@bix.com).

### PRODUCT INFORMATION

**Apple Power Mac 6500**  
\$3000  
Apple Computer, Inc.  
Cupertino, CA  
408-996-1010  
fax: 800-505-0171  
<http://www.apple.com/>  
Enter 1084 on Inquiry Card.

**Motorola StarMax 5000/300**  
\$2899  
Motorola Computer Group  
Tempe, AZ  
512-434-1526  
fax: 602-438-4636  
<http://www.mot.com/computer/starmax/>  
Enter 1082 on Inquiry Card.

**Umax SuperMac C600/280**  
\$2395  
Umax Computer Corp.  
Fremont, CA  
510-226-6886  
fax: 510-623-7350  
<http://www.supermac.com>  
Enter 1083 on Inquiry Card.

1



2



3



## Windows NT made for PRIMERGY.

The trend is clear: Windows NT™ is conquering the IT market as a leading server operating system, alongside UNIX®. With Microsoft's NT, standard PC components can be used as server systems to provide users with outstanding price and performance levels. Microsoft also develops many of its software products on Primergy platforms, working in close cooperation with Siemens Nixdorf. Our Primergy servers are thus a perfect match for NT.

## PRIMERGY made for Windows NT.

The Primergy line means more power for the Windows NT world. As one of the first servers to use the Pentium Pro 200 MHz processor, they are scalable from the monoprocessor system for smaller networks up to multiprocessor configurations. Solutions based on server clustering enable Primergy servers to attain extraordinary levels of performance and availability. Patented memory, drive and power supply technology from Siemens Nixdorf, as well as integrated server management, guarantee high availability.

## The power of two made for you.

The positive market response to Primergy in Europe proves that we are on the right track with this concept and system quality. Siemens Nixdorf has quickly established itself as one of the leading suppliers of PC servers. International companies not only benefit from the high availability of our Primergy servers – they also profit from our know-how and expertise when it comes to seamlessly integrating Primergy servers into existing IT environments.

Marketing-Fax: (+49) 5251/811418, <http://www.sni.de>

UNIX® is a registered trademark in the United States and other countries, licensed exclusively through XOPEN Company Ltd. Microsoft® is a registered trademark of Microsoft Corporation. Microsoft Windows NT™ is a trademark of Microsoft Corporation.

# Siemens Nixdorf: User Centered Computing

Circle 468 on Inquiry Card.

HOW WOULD YOU LIKE YOUR WORLD TODAY?

# TECHNOLOGY TODAY

## TOMORROW'S TECHNOLOGY TODAY

The national television series Technology Today will investigate the technological topics and trends that most affect the business world. Through informative symposiums, entertaining segments and exclusive interviews with today's leading industry experts, we will explore solutions to today's toughest business problems.

### JOIN THESE LEADERS

**SAMSUNG**

ELECTRONICS

**RICOH**

**Microsoft** Press

**MICRON**

Samsung: How are consumers and commercial PC users turning from 2D computing to 3D graphics, audio and full motion video? With the Alpha Microprocessor and Samsung. It delivers high-performance with 64-bit computing at frequencies up to 500 MHz and more.

Ricoh: Hear what you see. You can with the RDC-2 multimedia digital camera from Ricoh. The RDC-2 brings images to life by capturing the movements and sounds of your subjects. It's also an excellent presentation tool, plugging into any computer, TV or VCR for instant, high-resolution images.

Microsoft Press: Don't have time to keep up with what's happening in your field? The Best Practices Software Development Series from Microsoft Press makes it easy. It consists of five award-winning books written by experts in the software industry.

Micron Electronics: Micron Electronics presents the Millennia Transport — portable multimedia gear for the serious business professional. It's the high-performance, no-compromise desktop replacement you've been waiting for.

---

Technology Today airs Saturday afternoons at 4:00pm EST/1:00 pm PST on CNBC, to a potential reach of over 60 million households. Visit our World Wide Web sites at: [www.gsnetwork.com](http://www.gsnetwork.com) and [www.technologytoday.com](http://www.technologytoday.com) to get the latest solutions to today's technical issues.

This program is produced and paid for by



Global Solutions Network

21301 powerline road, boca raton, fl 33433  
phone: 561.477.3250 • fax: 561.477.3256 • [www.gsnetwork.com](http://www.gsnetwork.com)

an item in the Shutdown menu that says "eject PC"; execute that, wait a moment, and undock. It trundles for a bit and then you can either shut down entirely or put the machine to sleep.

You can "suspend" the machine either by software or with a hardware button. For some reason, the button is more prominent than the power button. It works well, once you remember that you get back in control not by pressing the suspend button again, but by a single press of the power button. Pressing the suspend button wakes the system up just long enough for it to realize that the suspend button was pressed, after which it goes back to sleep. This can be disconcerting until you figure out what's going on.

It wakes up right where you left it, for instance at the point where I left off typing this; and it comes on instantly. The suspend operation doesn't use much power, less than 10 percent for several hours.

Screen brightness noticeably changes when you go to battery power; it's still bright enough to see in broad daylight (from the correct viewing angle), although it's not as bright as the Nimantics Orion's screen. On the other hand, the batteries last a lot longer. If you're not using the CD-ROM drive, you can get nearly 4 hours of Word with the Armada, as opposed to a good bit less than an hour with the Orion. I also managed nearly 3 hours of battery life playing Interplay Productions' *Conquest of the New World*, a game that regularly uses the CD-ROM drive.

*Conquest* is a DOS program, and the Armada's power management didn't give much warning before it dumped me to the Windows 95 control screen; there's far more warning in Win 95 programs. On the other hand, an instant press of the suspend button preserved everything until I was able to bring up the system under outside power. I lost no data, not even the last move I made in the game. The bottom line is that I have got as much useful battery life out of the Armada as I have from any portable I ever had—and a lot more than I got from most of them.

The Armada comes apart. The top half is a neat portable using the main battery as a handle—a feature I like a lot. It's a bit heavier than the Gateway 2000 Liberty, but still small enough to carry to meetings. The bottom half contains the CD-ROM drive, better sound, the docking port, and another battery bay. You can wrap it up in pajamas and ship it in checked luggage, but

I've found it no great hardship to take the entire machine on an airplane. However, I do appreciate the take-apart feature when I want to take notes in a meeting.

My son Richard runs his business from an IBM ThinkPad. I could do the same with Armadillo, and I like its mushpad better than the eraserhead pointing device on the IBM systems. This Armada has a 166-MHz Pentium MMX, and I haven't found a game (or anything else, but games are a strenuous test) it doesn't run well. At 800-by 600-pixel resolution, text in Word looks all right (the higher the resolution, the better a good font such as Times Roman looks).

It's fast: Norton System Information reports a 26. By contrast, the Cyrix P-166 gets a 43. Benchmarks don't mean a lot: systems are either good enough or they aren't, and this one definitely is. For example, I can save this entire column, with Word set to make a backup—don't ever trust fast save—in a second or less, and

be up with the numbers, or above them, or even on the back side of the machine, or require a key switch. I don't use it a lot, and when I do, I certainly don't need it instantly accessible. If they can't move Caps Lock, I wish they would give me the option of changing it so that I'd have to do Shift Caps Lock to turn it on.

My only real complaint is that the screen could be just a little brighter under battery power; but, of course, that would come at the expense of battery life, and it's not as if this isn't good enough for real work. I could also wish it were a bit lighter, but I've never had a portable I didn't wish that of. Faced with a trade-off between weight and features, I tend to take features every time and carry a roll-on travel case that leaves ruts in the Tarmac; and with the Armada, I can take the top half to meetings.

Incidentally, redocking is incredibly easy: just push the machine into the docking port. It realizes instantly that things

## Benchmarks don't mean a lot: systems are either good enough or they aren't.

all 100,000 words of *The Burning City* are saved in under 2 seconds. Even for someone who saves as often as I do, there's not much room for improvement with more speed. What more do I need?

The keyboard is small, but it's more than adequate. Back at the airport, I got some real work done with this machine, and if I had any room, I'd be able to do some work now instead of playing *Conquest of the New World*. I was also able to do some Visual Basic programming while waiting in the doctor's office the other day. All told, this is a great portable.

A couple of complaints, neither exclusive to the Armada. First, the Caps Lock key. I've become used to the idea of Ctrl being on the row with the space bar, and given that the convention for select all is Ctrl-a, I even prefer Ctrl down there. It's all too easy to hit Ctrl-a on a portable with its smaller keys, and if you do hit Ctrl-a and then another key, you can lose all your work. Word has an undo feature, but some of the communications editors I have don't; so I am not only resigned to Ctrl being away from the A key, I welcome it. I realize that's a shock to some readers.

Alas, it was replaced by the Caps Lock key, and that one is also all too easy to hit; this doesn't result in a disaster, but it's very annoying. If left to me, Caps Lock could

have changed, trundles a second, restores the network, and Bob's your uncle. I love it. If you're looking for a full-featured laptop, either as a second machine or your only one, look at the Armada. Highly recommended.

MENTIONED ABOVE THAT WHITE on blue was a feature added to Word at my request. It's one reason I use Word, although the chief reason we switched was the document-comparison/revision-detection capability. Anyway, I have another request, this time for a feature Symantec added to Q&A Write when I asked for it.

I need a better word count.

Q&A Write had this neat feature: Ctrl-F3 brought up a small box that showed the number of words, the number of lines, and the number of paragraphs before the cursor, after the cursor, and in the entire document. The product manager said it was an easy feature to add.

This was wonderful for writers. I could set line lengths and then write the exact number of lines needed. For some assignments, that can be critical. Moreover, I could keep a bunch of notes at the bottom of a text file, start at the top writing finished text, put the cursor at the end of the actual text, and find out instantly

# PKZIP®

## for Windows

Version 2.50 Compatible with

- ✓ Windows 95
- ✓ Windows NT
- ✓ Windows 3.1x

### Why use PKZIP for Windows?

- Save on-line time charges and save disk space.
- Compress files an average of 50-70%. Many large files compress well over 90%.
- Open .ZIP archives downloaded from the Internet.
- Simple point-and-click interface.
- PKZIP 2.50 for Windows includes a separate 16-bit and 32-bit program.
- Combines the best and fastest patented compression technology found in PKZIP 2.04g.

### Other PKWARE Products:

**PKLITE® & PKLITE Professional® for Windows**

Put your executables on a diet!

### PKWARE Data Compression Library®

Put compression in your application.

Separate versions available for DOS, DOS32, Windows, Win32, OS/2, UNIX & MacOS.

To order call  
**414-354-8699** or  
 visit our web site  
<http://www.pkware.com>



1992-1993 PC World World Class Award  
 1996 Government Computer News  
 1995 New Product Award at FOSE Finalist  
 1993 Computer Current Readers Choice Award  
 1992 Shareware Industry Award  
 1992 Premiere Computing Magazine Award  
 1992 Dvorak/Zoom Award

**PKWARE, Inc.**  
 9025 N. Deerwood Drive  
 Brown Deer WI, 53223 USA  
 FAX: 414-354-8559  
 Email: [info@pkware.com](mailto:info@pkware.com)

Copyright 1997 PKWARE, Inc. All Rights Reserved. All trademarks or registered trademarks are the property of their respective owners. BY-1097

how much real text I had as opposed to notes. This is a valuable feature. Of course, you can sort of do it with Word by cutting and pasting and getting word counts for different windows, but that takes excessive effort; it's much nicer to simply hit Ctrl-F3. Please, fellows?

THE OTHER NIGHT, I DOWN-loaded Netscape Communicator, which is a step up from the last version of Netscape Navigator Gold. It works pretty well and has some nifty new features. It's not hard to install, and it's fairly easy to use. Alas, it has some instabilities. I don't remember the last time Navigator Gold crashed, but I've had three crashes with Communicator. None of them were serious: the program shut down without terminating my Internet connection and didn't seem to affect Win 95.

ital camera, and mind you, that wasn't one of the problems. Olympus sent me a parallel-port version of the software; it works, and so does what they have up on the Web now. It may not be simple enough for unsophisticated users yet, but BYTE readers won't have any trouble with it.

ERIC POBIRS, THE CHAOS MANOR intern, has been testing ATI's All-In-Wonder board and has this to say:

"At \$329, the ATI All-In-Wonder (AIW) video board deserves the title. In a single slot, ATI provides 2-D and 3-D video acceleration, MPEG-1 decoding with full-screen scaling, video still capture, motion-video capture, NTSC output (via composite and S-Video), NTSC input from direct and cable (up to 125 channels), close-caption display and capture, and channel scheduling. While some competitors offer compara-

## Every now and then, the Internet delivers rewards great enough to keep you trying.

I say seem to because hours later I did have some problems, applications running unusually slow, that sort of thing, which were cured by shutting down and bringing the system back up. That sort of thing used to be fairly common but hasn't been for weeks now, and since the only unusual event in the last hours was the Communicator crash, I have my suspicions.

For all that, I'll keep using Communicator, which has a nicer interface and works well indeed when it's working.

I consider the Internet a form of black magic anyway. Half the time on the Internet is spent waiting for something—anything—to happen, and half the remaining time, what is happening isn't interesting. On the other hand, it's a bit like fishing for steelhead trout. Most of your time is spent being miserable, waist-deep in freezing water; but catching one is rewarding enough that you will try again. Every now and then, the Internet delivers rewards great enough to make you keep trying.

MEANWHILE, I'VE ALSO BEEN improving my Web site. Go to <http://www.earthlink.net/~jerryp/> to have a look—and while you're on the Web, drop by the BYTE site and read the Web Exclusive part of this column for much more on some of the problems I've encountered.

I've added some photographs taken with my wonderful Olympus D300-L dig-

ble feature sets by adding daughterboards, ATI's approach is more compact, more convenient, and less expensive.

"Installation gave some problems. RacingCow, the Gateway P-133 I installed the AIW into, also has a recently installed digital videodisc (DVD) kit. The first generation of DVD drives cannot read CD Recordable (CD-R) discs. One guess what format the ATI software came on.

"We installed the software over the network. Note that the default for CD-ROM (and all other) drives is not shared. Once we set sharing on the remote machine, we could install the AIW software.

"A full installation of the ATI software is more difficult than it should be. To enable all the features (and why buy the board otherwise?) requires invoking the installer several times. Common off-the-shelf tools such as InstallShield allow for complex installations and should be able to deal with the multistage operation called for here. At least the installation is covered in the printed documentation. Little else is. Mastering the interface is a bit confusing at first. I expect it's covered in on-line form somewhere, but a dozen pages added to the manual would have been appreciated.

"That aside, the software is good. The tabs added to the Display control panel allow more adjustments than most other video boards. The video capture/playback is well designed once you understand the

You've already heard that...

**MicroGuard Copy Protection is**

**UNBEATABLE**

So...Here's how you can reach us:

[www.micromacro.com](http://www.micromacro.com)

International

Micro Macro Technologies, Ltd.  
3 Hashikma St.  
P.O.Box 11516, Azur 58001  
Israel

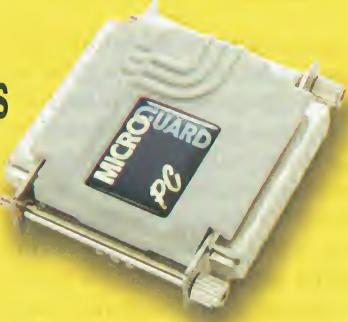
Tel: (972-3) 558-2345  
Fax: (972-3) 558-2344  
E-mail: [info@micromacro.com](mailto:info@micromacro.com)

USA

MicroGuard  
631 South Pontiac St.  
Denver CO. 80224  
USA  
Tel: (303) 320-1628  
Fax: (303) 320-1599  
E-mail: [usa@micromacro.com](mailto:usa@micromacro.com)

**MICROGUARD**

MicroGuard and MicroGuard PC are registered trademarks of Micro Macro Technologies, Ltd. All other product names are trademarks of their respective owners. Mac and the Mac OS logo are trademarks of Apple Computer, Inc. Windows and Flying Windows logo are trademarks of Microsoft Corporation.



**SEE YOU AT:**



Booth # S 8049



## Switching Jobs Can Have An Unfortunate Effect On Your Retirement Savings.



Don't Lose 40% Or More Of Your Retirement Plan To Taxes And Penalties.  
Call For Your Free Information Kit Today.

**T. Rowe Price** can help. Call for our free kit on managing the payout from your former employer's retirement plan. The kit clearly explains the pros and cons of all the distribution options, so you

can decide what's best for you. Because we'd hate to see your retirement plan go all to pieces.

**1-800-541-8335**



**Invest With Confidence**  
**T. Rowe Price**

Request a prospectus with more complete information, including management fees and other charges and expenses. Read it carefully before you invest or send money.  
T. Rowe Price Investment Services, Inc., Distributor.

IRAR037744

10 Mb, never needs attention, and is indispensable for my system.

Now they have the Magnum 600ES Personal Hub Plus. This has six 10Base-T sockets and runs at 100 Mb. You can switch one of the sockets to connect to a 10-Mb hub such as the H-80, so the device serves as a bridge. You can switch another socket to plug into another 100-Mb hub, so you can daisy chain these.

Most of my Ethernet is 10 Mb, because I haven't made any serious effort to collect 100-Mb Ethernet cards. However, both Armadillo and Princess, the dual-processor Compaq Professional Workstation 5000, have 100-Mb Ethernet, and I make no doubt I'll get other 100-Mb machines soon. I plugged the 100-Mb systems into the 600ES, left the 10-Mb systems plugged into the H-80, connected the two Garrett devices, and whammo! Garrett is to Ethernet hubs and bridges as Granite is to SCSI cables: rugged, reliable, and worry-free. Highly recommended.

**T**HE COMPUTER BOOK OF THE month is Edward Yourdon's *Death March: Managing "Mission Impossible" Projects* (Prentice-Hall, ISBN 0-13-748310-4). This is a manual on how to manage projects "doomed to failure" and turn them into successes. That sounds like pretentious nonsense, and coming from anyone but Yourdon, it probably would be; but this book is well worth your time and money. Yourdon's been there, and he can write; if you manage software projects and you're not the pointy-haired guy in "Dilbert," you will want this book.

The book of the month is a good novel by Victor Koman called *Kings of the High Frontier*. Unfortunately, it's intertwined with a bad novel and at least two dull political tracts. The book is about getting to space despite NASA and the government, and I kept reading it, but I have to say, I skimmed a fair amount. Mr. Heinlein said that he never saw a book that couldn't be improved by cutting from 10 percent to 50 percent; this one is no exception. It also suffers from putting characters in funny hats (literally in one case). In fairness, it covers a lot of territory, and big multi-viewpoint novels can get away from more experienced novelists than Koman.

Many years ago, I postulated "information utilities": places where you might put intellectual work, such as a novel. Those who want to read your work would pay a small fee direct to you. "Where," I

asked rhetorically, "is the need for that bloodsucking publisher?" In those days, I didn't realize that the physical production of books was one of the least of the tasks of the publisher. That gets contracted out anyway: few publishers own printing presses. What publishers do is edit books, arrange for publicity, and distribute them.

In Koman's case, distribution is electronic; visit <http://www.pulpless.com> for instructions. You can download the book in Adobe Acrobat or other formats. You

can also arrange to have a copy printed and mailed if you don't want to read it on-screen. Pulpless pays the author something like half the money received. I read the book on the airplane. I probably wouldn't have if I hadn't had a paper copy; reading it on-screen in an airplane seat would have been pretty grim.

Within a few years, however, I suspect we'll have small, portable "book machines" about the size and weight of a paperback and capable of reading discs off

smaller versions of a CD-ROM drive. The book machines will be as easy to read and as convenient to carry as a book. When they become widely available, they will completely change the publishing industry. It's not that books, especially hardbound books, will go away; but much of the mass paperback publishing will be displaced by personal book machines.

When that happens, there will still be the need for editors; and there will be so many books available that there will be an even greater need for reviewers.

It's late, and I'm out of time and space. Next month, more of same. Stay well. **B**

#### PRODUCT INFORMATION

##### All-In-Wonder

2 MB, \$299; 4 MB, \$329  
ATI Technologies  
Thornhill, Ontario, Canada  
905-882-2600  
fax: 905-882-2620  
<http://www.atttech.ca/>  
Enter 1088 on Inquiry Card.

Armada 4160T about \$3999  
Compaq Computer  
Houston, TX  
281-514-0484  
fax: 281-514-4583  
<http://www.compaq.com>  
Enter 1089 on Inquiry Card.

##### Magnum 600ES Personal

Hub Plus \$1095  
Garrett Communications  
Fremont, CA  
510-438-9071  
fax: 510-438-9072  
<http://www.garrettc.com>  
Enter 1090 on Inquiry Card.

Monster Sound \$179.95  
Diamond Multimedia  
San Jose, CA  
800-468-5846  
fax: 408-325-7070  
<http://www.diamondmm.com>  
Enter 1091 on Inquiry Card.

##### Netscape Communicator 4.0

\$59 (Standard Edition)  
\$79 (Professional Edition)  
Netscape Communications Corp.  
Mountain View, CA  
800-638-7483  
650-254-1900  
fax: 650-528-4138  
<http://home.netscape.com>  
Enter 1092 on Inquiry Card.

*Jerry Pournelle is a science fiction writer and BYTE's senior contributing editor. You can write to Jerry c/o BYTE, 29 Hartwell Ave., Lexington, MA 02173. Please include a self-addressed, stamped envelope and put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on the Internet or BIX at [jerryp@bix.com](mailto:jerryp@bix.com). You can visit the Chaos Manor Web site at <http://www.earthlink.net/~jerryp/>.*

FREE to Job Seekers

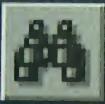
# Looking for your best career move?

**BYTE JobNet**

NEW

For nationwide exposure to hiring companies seeking quality Information Technology personnel, join the BYTE JobNet Registry today. For more details, click [BYTE JobNet Quick Tour](#) on our Web site.

**Hundreds of IT jobs! Find out instantly if you qualify!**



Search the  
BYTE JobNet  
IT Job Bank.



Register  
online for  
free!



Create an  
updatable  
online resume.



Reply  
automatically  
to any jobs.



Receive IT job  
notifications  
by E-mail.



Choose when  
to reveal your  
identity.

**WWW.  .com/jobnet**

A partnership with Elephant Online Information Technology Employment Matching Service

Technical recruiters: To become a new client of BYTE JobNet, E-mail [sales@elephantonline.com](mailto:sales@elephantonline.com), or call 1-800-632-7946.

Code: ITCG-B002

# Big Things Come in Small Packages... **SuperSlim Computer**



2.4"

## Ready-to-run 5x86 PC system with LCD display in an ultra-thin chassis.

- Flexible Installation
- Networking Capability
- Optional Touchscreen for Silent and Quick Operations
- Offering Maximum Work Space with Only 2.4" Depth



## Wall Mount

## Retail, restaurant, process control, home automation and educational applications



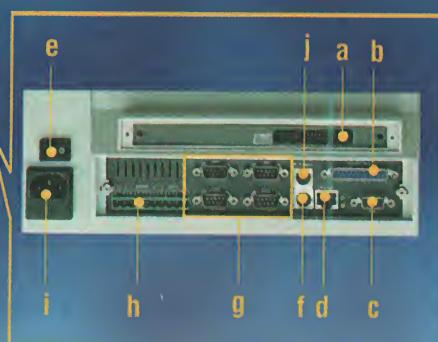
## Panel Mount

## Banking, gaming, recreational and medical services, retail and hospitality point of sales (POS)



## Desktop

## Webserver, registry counter and precision machinery applications



**Call 1-800-800-6889 now!**

American Advantech Corp.

750 East Arques Ave., Sunnyvale, CA 94086  
E-mail: [lcinfo@advantech-usa.com](mailto:lcinfo@advantech-usa.com)  
Homepage: [www.advantech-usa.com](http://www.advantech-usa.com)

# Industrial Automation with PCs

# ADVANTECH

Industrial Automation with PCs

### *Sunnyvale.*

*Sunnyvale.*  
Tel: 408-245-6678  
Fax: 408-522-1883

## Atlanta:

Atlanta.  
Tel: 770-409-7878  
Fax: 770-409-7895

Circle 174 on Inquiry Card.

**AUTOMATICALLY DECODES AND COPIES  
VIRTUALLY ANY CD FORMAT.**  
*CD-ROM, Audio, CD-DA, CD-XA,  
Mac, Mixed Mode, and ISO 9660.*

**INTERNAL A/V HARD DRIVE.**  
*Stores bit-by-bit disk images  
for instant duplication.*

**EXTERNAL SCSI PORT WORKS  
LIKE A FAST CD WRITER.**  
*Connect it to your PC or Mac  
and use it to design custom CDs.  
Software included free!*



**TOTALLY SELF-CONTAINED.**  
*No additional hardware or software  
is required.*

**AUDIO EDIT FEATURE.**  
*Allows you to select and copy  
Audio CDs, track-by-track, or  
disk-at-once, to create your own  
custom Audio CDs. You can  
arrange your music to suit yourself.*

**AVAILABLE IN STANDARD 19" RACKMOUNT.**  
*Call today for multi-drive & high speed  
industrial duplicator specifications.*

# COPY ANY CD CREATE AUDIO CDS NO COMPUTER REQUIRED

## CD DUPE-IT!

Instantly duplicate CD-ROM disks for software distribution. Make spare backup copies of your valuable software. Produce disks quickly and economically. No CD design or multimedia production is required.

## HOW EASY IS IT?

One-button operation means

**BUY MANUFACTURER DIRECT: \$1295**

**408-743-8732**

anyone can use CD Dupe-It! Simply insert your original disk and push "enter." The onboard fast multimedia processor decodes the CD format and copies it to the internal A/V hard drive. Insert blank recordable disks and make

as many exact copies as you like. You'll easily and quickly produce identical bit-for-bit duplicates.



**CORPORATE SYSTEMS CENTER**  
[www.corpsys.com](http://www.corpsys.com)

CD DUPE-IT! IS SOLD AND INTENDED FOR BACKUP AND IN-HOUSE DUPLICATION PURPOSES ONLY. COPYRIGHT LAWS MUST BE OBSERVED. CALL FOR RACK MOUNT AND MULTI-DRIVE COPIERS.

Lotus.

.domino™



# JOIN US!

## LOTUS DOMINO WEB DEVELOPERS' CONFERENCE 97

October 7-8, 1997

MOSCONE CENTER • SAN FRANCISCO, CA

### what you get

*Only at the Lotus Domino Web Developers' Conference 97 will you hear the latest announcements about a technology which is transforming both site and application development processes; gain the knowledge you need to implement and utilize Domino-based tools and services; and learn how to dramatically expand your customer base and business value of your Web applications with Domino 4.6. And, this is one of the first places where you'll be able to catch a glimpse of Release 5.0!*

You'll get more than just the usual three day tradeshow in **San Francisco's Moscone Center**...check out the highlights for the Lotus Domino Web Developers' Conference 97:

- ▶ **3 Keynote Sessions**
- ▶ **4 Technical Education Tracks** focused on Domino 4.6 including Application Development, Business Solutions, Deployment and Programmability
- ▶ **Domino Partner Pavilion** with more than 25 exhibitors each displaying the latest implementations of Release 4.6
- ▶ **Lotus Learning Lab (L3)** where developers get one-on-one face-time with Lotus Education
- ▶ **The Playroom** where you can climb onto a mock rock with the sponsors of the Colliers Lotus Notes Everest Expedition to find out rock climbing IS as difficult as it looks
- ▶ **The Cafe** where you relax, revive and reconnect...take advantage of our couches, cappuccino and e-messaging center or sit-in on a "Meet the Expert" discussion
- ▶ **2000** face-to-face opportunities to network with other developers
- ▶ **Welcome Reception at the Thirsty Bear**, a hot San Francisco micro-brewery
- ▶ **The Gala Party** at the unique Exploratorium on the site of the 1915 Panama-Pacific International Exposition

...and much more!

more  
info:

888.454.5525 or 415.570.6936

<http://www.lotus.com/domino/devcon97>

# Managing Multiple Servers?



## Think MasterConsole for Rock-Solid Control

### Save Time, Space, & Money

MasterConsole is the premier KVM switch, engineered to provide complete, reliable control of all your systems from a single keyboard, monitor, and mouse. It improves operations and eliminates the cost and clutter of unnecessary peripherals to save you time, space and money.

### Hardware & Software Independent

MasterConsole's unique technology enables flawless control of 2 to 64 computers in any combination of

PCs, Macs, and Suns, running any operating system or application software. Thousands already rely on MasterConsole. So can you!

For more information call

**800-RCI-8090 ext. 71**



"We tried other products but they were flat-out unreliable. MasterConsole is rock-solid."

Rick Jorgenson  
Manager, Information Systems  
Pecor



## Raritan

Raritan Computer Inc. Tel. 908-764-8886  
400 Cottontail Lane Fax 908-764-8887  
Somerset, NJ 08873

E-mail [sales@raritan.com](mailto:sales@raritan.com) <http://www.raritan.com>

MasterConsole and MasterView are trademarks of Raritan Computer Inc.

See Us At NetWorld+Interop in Atlanta  
October 8-10, Booth 8012

ISO 9001 Certified

## Custom **ULTRA** SCSI Cables - Terminators - Cases

If you want Ultra SCSI Performance use our Teflon Cables & Active Terminators.



Four models available with optional Remote LED Pak. These are the finest terminators available, they fix SCSI problems and improve reliability.

Benefits:

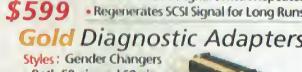
- Improves SCSI Bus Performance
- Less Errors, More Reliable Data Transfer
- Diagnoses Problems • Analyzes Signal Quality
- Active Regulation • Fast 50 & Fast Wide 68
- Status Indicators • Gold Contacts



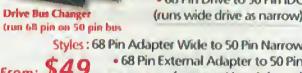
Benefits:

- Up to 14 Devices to 1 Computer
- Share Devices Between 2 Computers
- Features:

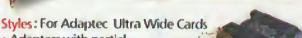
  - 2-1 Active Digital Switch/Repeater
  - Regenerates SCSI Signal for Long Runs



Styles: Gender Changers  
• Both 50 pin and 68 pin (all combinations)



Styles: 68 Pin Adapter Wide to 50 Pin Narrow  
• 68 Pin External Adapter to 50 Pin (converts Host Adapter)



From: \$49 Styles: 68 Pin Adapter Wide to 50 Pin Narrow  
• 68 Pin External Adapter to 50 Pin (converts Host Adapter)



From: \$49 Styles: For Adaptec Ultra Wide Cards  
• Adapters with partial termination built in for 68 to 50 converters (converts Host Adapter)

### SCSIVue Gold Diagnostic Cables



- No Loss Of Important Data
- Faster Performance
- Test Cable Integrity
- Features:

  - Diagnostic Indicators • Large Ferrite Filters
  - Triple Shielding (Unique Design)
  - Double Gold 20u" Plated Connectors
  - Extra Heavy 26 Gauge Wire • 100 Styles in Stock

### Teflon® 90 Ohm External Cables

From: \$159

- Benefits:

  - Ultra SCSI 40 MB/s operation
  - Fixes Ultra SCSI Cable Problems
  - Features:

    - Perfect 90 Ohm Impedance Match
    - Triple Pronged Connector With Gold contacts

### Gold .8mm Ultra SCSI Cables



- Benefits:

  - Faster Performance
  - Test Cable Integrity
  - No Loss Of Important Data
  - Features:

    - New .8mm Ultra SCSI Connector
    - Triple Shielding (Unique Design)
    - Double Gold 20u" Plated Connectors
    - Diagnostic Indicators • Large Ferrite Filters

### HOT SWAP Pull Out Bays

Compatible with all 50 pin & 68 pin

### Gold External Ultra SCSI Cases

Ultra SCSI Custom Teflon Cable Available

Custom Enclosures in 1 Day for Raid & Arrays

From: \$99



NEW! Temperature ALARM!

Automatic Monitor & Control

The Vertical 3.5" Case Kit offers a

small transportable package. Ideally suited for moving around, this durable case can take a beating. Universal 35 Watt power supply.

From: \$59

The Horizontal 3.5" or 5.25" Case Kit

Offers a stackable solution for any desktop need. Shown with Optional Bay Cooler installed.

Open Face and Closed Face Models Available.

Optional 50 or 68 Teflon® Cables Available.

Dual Fan & Bracket \$29

Bay Cooler Kit keeps those

HOT Ultra SCSI Drives COLD as ICE!

From: \$29

Large Frame Anti-Static Mats

For 3.5" Drives, 5.25" Drives, and 3.5" Drives

### Custom Teflon® Internal Cables

Ultra SCSI Custom Teflon Cable Available

Custom Enclosures in 1 Day for Raid & Arrays

From: \$39

50 Pin Replacement Cable for External Drive Cases

68 Pin Replacement Cable for External Drive Cases.

### Active Digital SCSI Repeater

From: \$139

Benefits:

- Models for all SCSI types
- Fixes SCSI Cable Problems

Features:

- Active Termination and Signal Purification
- Ultra Fast Performance for Added Capabilities
- Diagnostic Capabilities • 30u" Gold Contacts

### OEM SCSI Repeater

If you integrate SCSI Raids or Arrays and are having problems making it work, the Granite SCSI Repeater will make it work. Designed to fit inside any computer or external case.

### SCSI Cable Tester - LED Readout

This Digital SCSI Cable Tester can test all the popular cable styles for opens, shorts, and unreliable operation. Battery powered for easy use anywhere you need it.

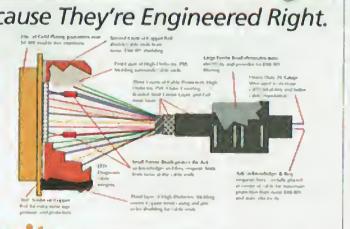
Three models to choose from:

- 50 pin IDC
- 50 pin Centronics
- 68 pin MicroD

From: \$49

### Granite Cables Are The Best Because They're Engineered Right.

Granite Cables were designed by SCSI Engineers to be the **Best Cables On The Market**. Everything about them means better performance and higher reliability. Our design incorporates an exclusive shield that protects the Acknowledge and Request lines from noise. Large Ferrite beads are installed on all cables to protect them from static and noise. Every cable incorporates a LED indicator that lets you know it is operating properly. We also use more **GOLD** on every cable. Add to this our impedance matching techniques and you have most of what makes us THE BEST!



Online Catalog at... [www.scisipro.com](http://www.scisipro.com) The SCSI Solution Company

Granite

Do-It-Yourself

3101 Whipple Rd. Union City, CA. 94587 Ph: 510-471-6442 Fax 510-471-6267

**PC DES/RSA CARD FOR MS-DOS, WINDOWS, WINDOWS NT, OS/2 & SCO-UNIX**

You can easily integrate the **PC DES/RSA card** in your client/server, PC or workstation environment or use it as a DES and/or RSA chip evaluation board at all stages from design to production.



European office:  
chaussée de Courcelles 113  
B-6041 GOSSELIES (BELGIUM)  
phone: +32.71/37.27.11  
fax: +32.71/37.27.69  
e-mail: info@vasco.com

**Features**

- High speed DES encryption, supports all DES modes including triple DES, MAC, & key generation
- High speed RSA encryption up to 1033 bit keylength, and battery back-up storage
- Hardware true random DES and RSA key generator, BOOT ROM socket

U.S. office: 1919 S. Highland avenue, suite 118-C, LOMBARD, IL 60148  
phone: +630.932.8844 fax: +630.495.0279

Circle 140 on Inquiry Card (RESELLERS: 141).

**The Communicator**

Run DOS from ROM. Stand alone 386 CPU has 7 Serial, Ethernet & PCMCIA **\$289+q1**

**KS-67** CPU with AMD 386-25MHz.  
Up to 6MB DRAM, FLASH, SRAM.  
7 std. Serial ports with FIFO (RS485),  
2 Par., PCMCIA, Ethernet & AT Bus.

**KILA**  
DOS-IN-ROM  
[www.kila.com](http://www.kila.com)



sales@kila.com  
303-444-7737  
Fax 303-786-9983

**Your solution for portable expansion and data acquisition**

- PCMCIa to ISA Bus expansion systems
- PCI Bus products— in stock
- LabVIEW™ Drivers available
- WinNT DDE-Server for InTouch
- Ask for your *FREE* 280 page Product Handbook

Buy Direct – Over 190 high quality data acquisition products!  
**20 Years Experience**



**Distributor & OEM**

inquiries welcome  
[www.contecusa.com](http://www.contecusa.com)



**CONTEC**  
MICROELECTRONICS USA INC.

2190 Bering Drive, San Jose, CA 95131

**1-800-888-8884**

Circle 153 on Inquiry Card.

**World's Fastest A/D Cards****CompuScope 8012A/PCI!!!**

- 100 MSPS, 12 Bit A/D Card on PCI Bus
- 100 MB/s Data Transfer Rate to PC Memory
- Up to 1 Meg Memory
- Extensive Software Drivers



**Gage**

Gage Applied Sciences Inc.  
1233 Shelburne Road, Suite 400, South Burlington, VT 05403

Tel: 1-800-567-4243 Fax: 1-800-780-8411 e-mail: [prodinfo@gage-applied.com](mailto:prodinfo@gage-applied.com) web site: <http://www.gage-applied.com>

Outside the U.S., contact Gage at 5610 Bois Franc, Montreal, QC, Canada H4S 1A9 Tel: (514) 337-6893 Fax: (514) 337-8411

**1-800-567-GAGE**

Ask for extension 3425

Circle 154 on Inquiry Card.

**Portable Data Acquisition**

216-439-4091 ▲ Fax: 216-439-4093 ▲ <http://www.iotech.com>

The following are trademarks of their holders: DASYLab, DASYTEC GmbH, DOS, Windows, Microsoft Corp., LABTECH INSTRUMENTS, LABVIEW, National Instruments, PCMCIA, Personal Computer Memory Card International Association, Snap-Master, PBM Data Corp.



Circle 155 on Inquiry Card.

**Virtual Instrument Developers Tools – Free Evaluation CD**

The new Software Showcase CD-ROM includes free evaluation versions of the industry LabVIEW graphical programming and LabWindows/CVI C/C++ development tools for virtual instrumentation. Also included are ActiveX controls for Visual Basic, Excel tools, and analysis and visualization software.

**National Instruments**

Phone: (512) 794-0100 Fax: (512) 794-8411  
(800) 433-3488 (U.S. and Canada)

E-mail: [Info@natinst.com](mailto:Info@natinst.com) WWW: <http://www.natinst.com>

Circle 156 on Inquiry Card.

**RACK MOUNT PC PRODUCTS****SINGLE BOARD COMPUTERS**

- 486 to Pentium Pro SBCs
- Up to 200MHz Pentium Processors
- Integrated video and SCSI models
- ISA and PCI passive backplanes

**NEW ATX ENCLOSURES****ENCLOSURES**

- 10" color or 9" mono SVGA monitors
- 8 and 14 slot ISA/PCI backplane models
- Systems built to customer's specifications
- AC and DC input power supply options

**MONITORS AND KEYBOARDS**

- 9" to 17" rack mount monitors
- Mono SVGA to Multi-frequency models
- Rack Mount keyboards with integrated mice
- Rack Mount monitor and keyboard enclosures

**PRINTERS**

- Inkjet printers and printer enclosures
- IBM graphics dot matrix printers
- Parallel or Serial Interface

Call for our free Rack Mount PC Product catalog

1-888-RECORTEC

Or visit our web page

<http://www.recortec.com>

**RECORTEC, INC.**

1290 Lawrence Station Road  
Sunnyvale, CA 94089-2220

Tel: (408) 734-1290

Fax: (408) 734-2140

E-mail: [info@recortec.com](mailto:info@recortec.com)

Circle 162 on Inquiry Card.

**Technoland...****Makes Industrial PCs Affordable**

- Single-board Computer from Dual Pentium® Pro to 486
- Fault-tolerant Systems
- PS/2 Redundant Power Supply
- PCI/ISA Backplane Series
- Full Line of Rack-Mount PCs
- Flat Panel PCs
- Industrial Workstation & Chassis



CELEBRATING  
10<sup>th</sup>  
ANNIVERSARY  
SERVING BUSINESS SINCE 1986

**Technoland Inc**

1050 Stewart Dr., Sunnyvale, CA 94086

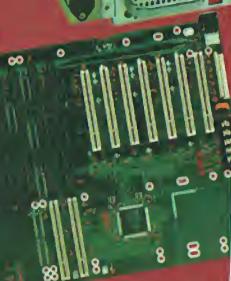
**1-800-292-4500**

Tel. 408-992-0888 • Fax. 408-992-0808

e-mail: [info@technoland.com](mailto:info@technoland.com)

Homepage: [www.technoland.com](http://www.technoland.com)

Pentium is a registered trademark of Intel Corp.

**Industrial Rackmount PC Enclosures****Rackmount Enclosures**

1U to 6U Configurations  
17 to 26 Inch Depths  
Multiple CPU Systems  
Integrated Monitor Units

Dual Motherboard Wide Body  
Wall Mount and Table Top Nodes  
Full Line of Rack Cabinets  
Over 60 Models Available

**Single Board Computers**

Pentium to Dual Pentium Pro  
Up to 233MMx Pentium Processors  
2 Slot to 20 Slot Passive Backplanes  
ISA/PCI Dual System Backplanes

**Peripherals**

Keyboard Drawers  
With Trackball and/or Mouse  
Rackmounted Switches,  
Monitors and Flat Panel Displays

**In House Manufacturing and Engineering  
Custom Units and Colors Available  
Enclosure Pricing From \$150.00**

**TRI MAP International, Inc.**

4569-A Las Positas Road - Livermore, CA 94550

Phone (510) 447-2030 - Fax (510) 447-4559

[www.rackco.com](http://www.rackco.com) or Email at [trimapintl@earthlink.net](mailto:trimapintl@earthlink.net)

Circle 161 on Inquiry Card.

**FASTEST DRAW (-ing speed) IN TEXAS.**

"Not to mention California."

**PERFORMANCE**

233mhz Pentium with MMX, 512K L2 (external) cache, 64-bit PCI graphics, up to 128MB of RAM, and 3GB of Hard Drive space all add up to make it 15% faster than our last 233mhz MMX notebook!

**SATISFACTION**

A 30-day money-back guarantee, plus the fastest tech support call response in Texas, too. Try it!



See our web site  
or call our friendly  
toll-free number  
for more details.

Micro International Inc. 10850 Seaboard Loop, Houston, TX 77099

Top quality PC's with excellent service and support since 1984!

Houston: (281) 495-9096, Fax (281) 495-7791,

Hours: 8:30-6 Monday-Friday.

**1-800-967-5667**  
Internet: <http://www.pcminit.com>

Circle 167 on Inquiry Card  
(RESELLERS: 168).

**A-Core™ & A-Engine™** PRICES START AT \$79 Qty 1 • \$28 OEM

**40MHz!**

• High Performance, Compact, Reliable  
• Easy to program in Borland/ Microsoft C/C++  
We have 20+ Low Cost 16-bit Controllers with ADC, DAC, solenoid drivers, relay, PC-104, PCMCIA, LCD, DSP motion control, 10 UARTs, 100 I/Os. Customer boards design. Save time and money.

**TERN INC.**  
216 F Street, Ste. 104, Davis, CA 95616, USA  
Tel: 916-758-0180  
Fax: 916-758-0181  
tern@netcom.com  
<http://www.tern.com>

**Circle 149 on Inquiry Card.**

## BYTE

### Breaks the 4-Color Price Barrier with the Hardware/Software Showcase

See how affordable it is to advertise to BYTE's 500,000 computer professionals in this section!

For more information call your BYTE sales representative (see listing, page 165) or fax 603-924-2683

## Control Anything...



### The PK2270™ EasyStart Kit

## EASILY

- The fastest, easiest way to develop control systems
- 30 I/O lines, RS232, RS485, rugged enclosure, LCD, & keypad
- Includes all necessary hardware, simplified software development system, step-by-step documentation and many sample programs.

### INNOVATION IN CONTROL TECHNOLOGY

Call 1-888-362-3387 toll-free for your PK2270 EasyStartKit or to receive a free catalog. We'll ship within 24 hours.

Come see us at ISA-TECH, booth #6124



2900 Spafford Street TEL 916-757-3737  
Davis CA 95616 USA FAX 916-753-5141

<http://www.zworld.com>

**Circle 148 on Inquiry Card.**

## Original Manufacturer

### All steel construction Server & RAID Chassis

#### SUPPORT

- Qual, Dual, Pentium Pro & ATX M/B



- AMI Goliath M/B
- Digital Equipment Alpha M/B
- Intel ATX M/B
- Super Micro P6 NDH M/B



NS-1400

MS-1620  
DUAL M/B

- Front access with 14 x 5 1/4" exposed drive bays (NS-1400)
- Front access with 16 x 5 1/4" exposed drive bays (MS-1620)
- Heavy duty power supply options 400W-600W
- Hot-Swap Redundant 2 x 300W, 2 x 400W, 3 x 300W
- Also available other Server & RAID Chassis

#### REMOVABLE HOT DRIVE MODULES

- WIDE SCSI, SCSI or IDE Available, Patent protected
- Perfect for RAID & removable storage application



AEH CORP.

254 S. 5th Ave., La Puente, CA 91746  
Tel: (626) 369-2608 • Fax: (626) 961-0468

©1997 A E Home corporation. All rights reserved. All other products or services mentioned herein are brands and trademarks of their respective companies

**Circle 151 on Inquiry Card (RESELLERS: 152).**



Surprised  
at your  
web hosting  
rates?!

Then call ValueWeb today, the world's  
most affordable web hosting service!

**\$19 95 MO**  
No Minimum Contract!

- Domain name registration provided ([http://www.your\\_name.com/](http://www.your_name.com/))
- Access to our SSL secure server
- Your own CGI-bin directory
- Anonymous Virtual FTP
- E-mail forwarding
- Your own FTP account
- 13 connection to the Internet!
- 1000 Mb of data transfer per month
- Daily tape backup
- Choice of UNIX and Microsoft® Front Page
- Auto web usage statistics
- Auto E-mail responders
- 25 Mb of disk space
- Truespeech® server support included (real time audio)
- Some day setup
- POP3 E-mail accounts

30 Day Money Back Guarantee!

**ValueWeb**

The #1 Choice for Professional Website Developers.

Ask about our reseller program!

**1-888-846-7756**

Save \$10 When You Register Online! • [www.valueweb.net](http://www.valueweb.net) • E-mail: [sales@valueweb.net](mailto:sales@valueweb.net)

**Circle 171 on Inquiry Card.**

# THE BUYER'S MART

A DIRECTORY OF PRODUCTS AND SERVICES

**THE BUYER'S MART** is a unique classified section organized by product category to help readers locate suppliers. Ads may have inquiry numbers to aid readers requesting information from advertisers.

**AD FORMAT:** Each ad will be designed and typeset by BYTE. Do NOT send logos or camera-ready artwork. Advertisers should furnish

typewritten copy. 2" x 1 1/16" ad can include headline (23 characters maximum), descriptive text (300 characters is the maximum recommended) plus company name, address, telephone and fax number. 2" x 2 5/8" ad has more space for descriptive text (850 characters is the maximum recommended). **DEADLINE:** Ad copy is due

approximately 2 months prior to issue date. For example: November issue closes on September 15. Send your copy and payment to: **THE BUYER'S MART**, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information please call Mark Stone in BYTE sales at 603-924-2533 or FAX: 603-924-2683.

## RATES (January 1997)

	3-5 ISSUES	6-11 ISSUES	12 ISSUES
1 ad	\$820	\$790	\$690
2" x 1 1/8"	2 ads/issue	"	660
	3 ads/issue	"	620
1 ad	\$1,640	\$1,580	\$1,380
2" x 2 5/8"	2 ads/issue	"	1,320
	3 ads/issue	"	1,250

\*\*\*\*\*COLOR - Add \$100\*\*\*\*\*

## BARCODE

### Bar Code Headquarters

- Complete Bar Code Readers from \$299
- Portable Bar Code Readers from \$759
- Laser Gun Readers from \$549
- Cordless Scanners from \$595
- Two way RF Terminal - \$1095
- Bar Code Labeling Software for Windows - \$295 DOS Version - \$279
- Bar Code Fonts for Windows/Mac - \$199
- Direct from Manufacturer

### Worthington Data Solutions

800-345-4220

Phone: 408-458-9938 • Fax: 408-458-9964  
In UK call 0800 293 213  
In France call 0800 90 65 47  
In Germany call 0130 8150 84  
Rest of Europe call 353 1 6614 566

## CAD/CAM

### CONTOURING MOTION CONTROL FROM A PRINTER PORT!

Indexer LPT™ software \$249  
VERSION 3 VISA/MC

- Controls up to six step motors simultaneously.
- Linear and Circular Interpolation.
- New features to accommodate machine control.
- Easy-to-use device driver. Super Manual.
- CAD-CAM interface available.

Ability Systems Corporation, 1422 Arnold Ave.  
Roslyn, PA 19001 (215) 657-4338  
FAX: (215) 657-7815  
<http://www.abilitysystems.com>

Inquiry 381.

## CD-ROM

### CD-ROMS

Windows95.com 32-bit Shareware Collection \$35.00  
Compilation of "www.windows95.com" website 32-bit Shareware Section.  
LINUX Developers Resource 6 CD set \$27.50  
Print & Design, Slackware, MetroX Server, On-Line Docs.  
LINUX Toolbox \$15.00  
Includes 6 CD Set with 600 Page Manual!  
Programming Languages \$25.00  
HEXX, Oberon, Modula-2, Modula-3 (pre-built binaries) Scheme/Jac  
Standards \$30.00  
Domestic and international networking standards.  
Webmaster Tools Volume 1 \$35.00  
Everything needed to generate and promote web pages.  
Webmaster Tools Volume 2 \$35.00  
Everything you need to run and administer a web server.  
Webmaster 3 \$35.00  
Includes all the advanced aspects of web design including Video, VRML and more!  
Workgroup Server New Version \$75.00  
Print and File Sharing for DOS, WIN, MAC, OS/2 and NT under LINUX.  
MOO-TER for LINUX - 100% Motif Compatible GUI - for LINUX \$99.00  
Virtual Box Tools \$35.00  
Latest shareware tools and utilities. Database, multimedia & refined VBX controls.  
WinSite CD-ROM Set \$35.00  
Shareware for Windows 3.1, NT and 95  
Pawn to King \$30.00  
Over 2,000 Ebooks of classical literature, government, biology, kids & fairy tales.  
Programmers Heaven \$30.00  
Contains over 8500 files and more than 630 packed megabytes of information about every aspect of programming that you can imagine!  
Phone Orders: 1-800-800-6613 We accept  
Fax Orders: +1-520-526-9573 MC, VISA & AMEX  
Int'l Phone: +1-520-526-9565  
Web Orders: [www.infomagic.com](http://www.infomagic.com) E-mail: [orders@infomagic.com](mailto:orders@infomagic.com)  
**InfoMagic** 11950 N. Hwy 89, Flagstaff, AZ 86001

Inquiry 384.

## DATA RECOVERY

### We Can Save It!

All Platforms - All Storage Devices  
Proprietary techniques so advanced we  
rescue data others simply abandon.

### DRIVE SAVERS

Restoring data since 1985  
**1-800-440-1904**  
415-883-4232

Inquiry 385.

## DATA RECOVERY

### Data Recovery Service

From one of Europe's largest disk drive manufacturers

- 24 hour, 7 day hotline
- Data promptly restored and returned
- SSA capability
- No fix, no fee

Call now: +44(0)1705 443283 or (0)374 136170  
On-line information: [www.xyratex.com](http://www.xyratex.com)

**Xyratex**

Inquiry 388.

## DATA/DISK CONVERSION

### CONVERSION/DUPLICATION

Tape: 4MM, QIC, 8MM, DLT, 9-Trk, 3480/90/90E  
Disk: 3", 3 1/2", 5 1/4", 8" CD-ROM

**1-800-357-6250**

Shaffstall Corporation 317-842-2077  
7901 East 88th Street Fax 317-842-8294  
Indianapolis IN 46256 sales@shaffstall.com  
Since 1973 <http://www.shaffstall.com>

## EDUCATION

### EARN B.S. AND M.S. IN COMPUTER SCIENCE THROUGH DISTANCE EDUCATION

- Object oriented B.S. program
- New courses in Java, Networking, HTML, MIS
- Approved by more than 275 companies
- Follows ACM/IEEE guidelines

Free catalog 1-800-767-AICS or  
<http://www.aics.edu>.

Accredited: World Association of Universities & Colleges

## HARDWARE

### HEWLETT-PACKARD

#### Buy - Sell - Trade

LaserJet ColorPro DeskJet  
DraftPro RuggedWriter DraftMaster  
Electrostatic Plotters  
We specialize in Demo & Refurbished Equipment  
HP 9000 Workstations and Vectras also available.  
**Ted Dasher & Associates**  
4117 Second Ave., S. Birmingham, AL 35222  
Phone: (205) 591-4747 Fax: (205) 591-1108  
(800) 638-4833 E-mail: [sales@dasher.com](mailto:sales@dasher.com)

Inquiry 389.

## INTERNET PRESENCE

### Virtual Web Hosting • 3-T3 Connections!

**www.YourName.com**

**\$19.97/mo.**

(800) 808-9241 / FREE "web" Page  
<http://PICK.NET> RESELLERS Welcome

Inquiry 390.

1

## CD-ROM

### CD-R Media \$3.99

Recorders, DVD, Towers  
303-384-3922 FAX 303-384-3926  
<http://www.cdrominc.com>

Inquiry 383.

Don't pay thousands of Dollars! Download our

### DO-IT-YOURSELF

Data Recovery Software

### TIRAMISU.

We support DOS, WINDOWS, NOVELL and NTFS file systems

<http://www.recovery.de>

Email: [data\\_recovery@compuserve.com](mailto:data_recovery@compuserve.com)

The Virtual Data Recovery Company

Inquiry 387.

# ADVERTISER CONTACT INFORMATION

To order products or request free information, call advertisers directly or send in the Direct Link Card by mail or fax! Let them know you saw it in BYTE!

INQUIRY NO.	PAGE NO.	PHONE NO.	INQUIRY NO.	PAGE NO.	PHONE NO.	INQUIRY NO.	PAGE NO.	PHONE NO.
<b>A</b>			<b>E</b>			<b>P</b>		
142-143 ACI SYSTEMS	157	800-983-1177	444 ERGOTRON INC	32IS 13	+31 20 696.60.65	453-454 PANDA SOFTWARE INTERNATIONAL	32IS 18	+34-1-332-0054**
151-152 AE HOME CORPORATION	160	626-369-2608	447-448 E-TECH	49	+886-35-777751**	127-128 PHILIPS BUSINESS ELECTRONICS	135	800-835-3506
85-86 ALADDIN KNOWLEDGE SYS LTD	75	212-564-5678	437-438 EUTRON	32IS 6	+39 35 201003	468-469 PHILIPS SEMI-CONDUCTORS	8-9	+31 40 272 4825*
87-88 ALADDIN KNOWLEDGE SYS LTD	12	847-808-0300	<b>F</b>			105-106 PKWARE INC	142	414-354-8699
174 AMERICAN ADVANTECH	148	800-800-6889	99 FAIRCOM CORPORATION	105	573-445-6833	175 POLYWELL SYSTEMS	149	800-300-7659
AMERICAN POWER CONVERSION	16A-B	401-788-2797	439-440 FAST SECURITY AG	32IS 5	+49-89-894221-20	123-124 POWERQUEST	35	800-379-2566
103 AMERICAN POWER CONVERSION	17	888-289-APCC ext 8199	451-452 FIRST INTERNATIONAL COMPUTER	32IS 2	+886-2-714-8696**	125-126 POWERQUEST	69	800-720-0399
AMERICAN POWER CONVERSION	64A-B	401-788-2797	179 FOREFRONT DIRECT INC	151	800-475-5831	160 PRECISION GUESWORK INC	159	508-887-6570
104 AMERICAN POWER CONVERSION	65	888-289-APCC ext 8251	<b>G</b>			<b>Q</b>		
163-164 APPRO INTERNATIONAL INC	157	800-927-5464	154 GAGE APPLIED SCIENCES INC	156	800-567-GAGE	107 QNX SOFTWARE SYSTEMS LTD	27	800-676-0566 ext 1047
122 ARTECON	127	800-USA ARTE	180-181 GRANITE DIGITAL	154	510-471-6442	QUANTUM CORPORATION	66-67	800-624-5545 ext 131
134-135 ARTMEDIA	119	+886-2-778-5850	441 GREY MATTER LTD	32IS 21+44(0)364-654200**	463-464 GTCTELE COMMUNICATIONS	32IS 26	+49-711-2387715**	
AVIATION WEEK	143	609-426-5526	<b>H</b>			<b>R</b>		
147 AVITECH INTERNATIONAL CORP	159	425-836-8970	169-170 HIWAY TECHNOLOGIES	161	800-339-HWAY	184-185 RAIDTEC CORPORATION	153	770-664-6066
<b>B</b>			190 HUMMINGBIRD COMMUNICATIONS	80A	416-496-2200	110 RAINBOW TECHNOLOGIES	5	714-450-7900
BYTE BACKISSUES	161	603-924-9281	<b>I</b>			182-183 RARITAN COMPUTER INC	154	908-764-8887**
BYTE CARD DECK	32IS 13	603-924-2596	144-145 ICPACQUIRE	157	800-500-4138	162 RECORTEC INC	158	888-RECORTEC
BYTE EURODECK	32IS 9	603-924-2533	100 INTEGRIX INC	111	800-300-8288	176-177 ROSE ELECTRONICS	155	800-333-9343
BYTE INTERNATIONAL	20-21		155 IOTECH	156	216-439-4091	<b>S</b>		
BYTE JOB NET	146	800-632-7946	<b>J</b>			111 SAMSUNG	29	
BYTE ON CD ROM	120	800-924-6621	150 JK MICROSYSTEMS	159	510-236-1151	466-467 SEH COMPUTERTECHNIK GMBH	32IS 28	+49-521-94226-0
BYTE SUBMESSAGE	143		156 KILA	156	303-444-7737	468 SIEMENS NIXDORF INFOSYS AG	136	
<b>C</b>			157 KILA	157	303-444-7737	165-166 SLIGER DESIGNS	157	702-356-5595
115 CENTRAL DATA	115	800-482-0397	159 KILA	159	303-444-7737	167-168 SOFTBANK/COMDEX	132	617-433-1600
457 CHECKPOINT SOFTWARE TECHNOLOGI	7	+972-3-613-1833	101-102 KINGSTON STORAGE	25	800-435-0670	129-130 SPOT TECHNOLOGY	80B	+866-3-587-8966
431-432 COMPEX INC	11	714-630-7302	<b>L</b>			112 STATSOFT	99	918-749-1119
89 COMPUTER ASSOCIATES	15	800-991-4438	460-461 LANTECH COMPUTER COMPANY	32IS 10	+886-2-766-7088	<b>T</b>		
90 COMPUTER DISCOUNT WAREHOUSE	40-41	800-959-4239	458-459 LEOPTICS INC	32IS 14	+886-2-755-0366	139 T ROWE PRICE	144	800-541-8335
COMPUTER PROFESSIONAL'S BOOK SOCIETY	121	614-759-3666	103-104 LOTUS DEVELOPMENT CORP	152		455-456 TATUNG	CV	+866-2-592-4569
91 COMTROL CORP	80E	800-926-6876	<b>M</b>			167-168 TECHNO LAND	158	800-292-4500
153 CONTEC MICROELECTRONICS	156	800-888-8884	150 MCGRAW HILL FIELD SALES	32IS 25		169 TECHNOLOGY TODAY	138	561-477-3250
92 COREL	50	613-728-0826 ext 3080	188 MICRO 2000	78-79	818-547-0397**	170 TECHNOLOGY TODAY	145	561-477-3250
178 CORPORATE SYSTEMS CENTER/CSC	150	408-743-8732	137-138 MICRO MACRO TECHNOLOGIES	144	+972-3-558-2345	149 TERN INC	160	916-758-0180
433-434 CYBEX COMPUTER PRODUCTS CORP	CVI	205-430-4000	443 MICRODATA SYSTEMS SRI	32IS 26	+39 1 87 988 460	136 TRACEPOINT TECHNOLOGIES	93	888-688-2504
93-94 CYBEX COMPUTER PRODUCTS CORP	55	205-430-4000	116 MICRON ELECTRONICS	CII-1	800-362-7306	161 TRI-MAP INTERNATIONAL INC	158	510-447-2030
<b>D</b>			449-450 MITAC	32IS 17	+886-3-328-9000	162 TV INTERACTIVE.COM	141	800-311-8001
465 DATA ENCRYPTION SYSTEMS LTD	32IS 27	+44 1823 352-357	158-159 MOXA TECHNOLOGIES	159	800-699-MOXA	<b>V</b>		
445-446 DBTEL	32IS 11	+886-2-268-2081	<b>N</b>			171 VALUE WEB	160	888-846-7756
95-96 DELTEC	112	800-DELTEC-1	156 NATIONAL INSTRUMENTS	156	800-433-3488	140-141 VASCO DATA SECURITY	156	+32 71 37 2769**
DIGITAL	8-9	888-ALPHA-45	442 NATIONAL INSTRUMENTS	32IS 24	800-433-3488	191 VENCOR	86	888-ROUTE-IS
120 DISTINCT CORPORATION	16	408-366-8933	146 NEATO LLC	159	800-984-9800	157 VIDEX INC	157	541-758-0521
121 DISTINCT CORPORATION	16	408-366-8933	156 NEC COMPUTER SYSTEMS DIVISION	56-57	1-888-8-NEC-NOW	113-114 VIEWSONIC	61	800-888-8583 AGENT1397
435-436 DISTRIBUTED PROCESSING TECHNOLOGY	32IS 12	407-830-5522	<b>O</b>			<b>W</b>		
131 DR. SOLOMON'S SOFTWARE	36	800-960-9095 ext 189	158 OSBORNE MCGRAW-HILL	128	800-822-8158	186-187 WIBU SYSTEMS AG	86	+49-721-93172-22**
97-98 DTK COMPUTER INC	39	800-289-2385				172-173 WORLDWIDE INTERNET PUBLISHING	161	800-785-6170
						<b>Z</b>		
						148 Z-WORLD ENGINEERING	160	916-757-3737
						117-118 ZYXEL COMMUNICATIONS	42	714-693-0808

# EDITORIAL INDEX

For more information on any of the companies covered in articles, columns, or news stories in this issue, enter the appropriate inquiry number on the response card. Each page number refers to the first page of the article or section in which the company name appears.

INQUIRY NO.	PAGE NO.	INQUIRY NO.	PAGE NO.	INQUIRY NO.	PAGE NO.	INQUIRY NO.	PAGE NO.
		<b>A</b>		<b>1050</b> Dell Computer	167	<b>1034</b> Logicode Technology	76
		Accton Technology	32IS 15	<b>1031</b> , Diamond Multimedia Systems	76,	Lucent Technologies	53,107
		Acer	32IS 3	<b>1032</b> ,	139	<b>M</b>	
		Act Networks	107	<b>1091</b>		Macronix	32IS 15
<b>1064</b>	Adaptec	167		<b>1048</b> , Diba	112NA 1	<b>1035</b> MaxTech	76
	ADSL Forum	71		<b>1048</b> , Digital Equipment	18, 167, 120K	MCI	107
	Advanced Services and Media	32IS 7		DirecPC	71	Micom	107
<b>1007</b>	Ahead Software	32IS 23		D-Link	32IS 15	MicroChip Technologies	112NA 1
	Alteon Networks	63, 120C		Dragon Systems	32IS 19	<b>1063</b> Microsoft	18, 107, 113, 167,
	Amati Communications	71		<b>E</b>		32IS 3, 120K	32IS 1, 112NA 1
	Amazon.com	107		<b>1015</b> Electrum Multimedia	32IS 23	<b>1081</b> Microtest	129
<b>1027</b>	Apex Data Div., Smart Modular Technologies	76		<b>985</b> Elmeg GmbH	32IS 23	<b>1008</b> Microtrop	32IS 23
	Apple Computer	133		Elvis+	32IS 7	Minolta	112NA 1
	Applix	87		emWare	112NA 1	<b>982</b> Miro	32IS 23
<b>1028</b>	Archtek America	76		Epson	18	Motorola	71
	Arescom	76, 167		<b>1051</b> Evergreen Technologies	167	<b>1082</b> Motorola Computer Group	133
<b>1054</b>	Exabyte	32IS 23		<b>1014</b>	32IS 23	<b>1023</b> , Motorola ISG	76
	Ariba Technologies	87		<b>F</b>		<b>1036</b> ,	
	Ariel Horizon	76		First Auction	87	<b>1037</b>	
	Art Technology Group	87		Fore Systems	18, 58	Motorola Lexicus Division	32IS 19
	Ascend Communications	58		Frame Relay Forum	58	Mylex: Network Power & Light	18
	AT&T	107		<b>G</b>		<b>N</b>	
<b>1088</b>	ATI Technologies	139		<b>1090</b> Garrett Communications	139	<b>1074</b> ncipher	167
	ATM Forum	58		<b>1070</b> Geomate	167	NCR	18, 120K
	Aware	76		Gigabit Ethernet Alliance	63	<b>1052</b> NEC	167
	Axis Communications	18		Gigabit Ethernet Consortium	63	<b>1097</b> Neologic Systems	122
	<b>B</b>			GlobalPhone Project	32IS 19	<b>1062</b> Netframe	167
	Bay Networks	120C		Globespan	71	Netrix	107
	BEA	95		<b>H</b>		<b>1076</b> , Netscape	95, 113,
	Bell Atlantic Large Business Services	58		<b>1066</b> HAHT Software	167	<b>1092</b> Communications	139, 167
	Bell Atlantic Network Services	71		<b>1022</b> , Hayes Microcomputer	71,	<b>976</b> Novell	137
	Best Internet	58		<b>1033</b> Products	76	Nuera	107
	Biodata	32IS 7		<b>1086</b> Hewlett-Packard	18, 167, 32IS 3,	Nyxex	107
<b>1021</b>	Boca Research	76			120C, 120K	<b>O</b>	
<b>1029</b>				<b>1075</b> Hilgraeve	167	<b>1095</b> , Object Design	101, 122
<b>1016</b>	Borland International	34		Home Automated Living	32IS 19	<b>1096</b>	
	<b>C</b>			Hughes Communications	71	Objectivity	101
	Canon	167		<b>1057</b> IBM	37, 95, 120K	ObjectShare	117
<b>1030</b>	Cardinal Technologies	76		<b>1057</b> Imation	167	Oracle	95
	CellularVision America	71		Innotech Multimedia	87	Orkit	76
	Centaur Technology	51		<b>1087</b> Integraph	167	<b>1094</b> O2 Technology	122
	Chorus Systems	112NA 1		Integrated Systems	112NA 1	<b>P</b>	
	Cisco Systems	18, 58		Intel	18, 107	Packet Engines	63
<b>999</b>	CNet Technology	32IS 15		Ipsilon	47	Pair Gain	76
	Com-EM-Tex	32IS 23		<b>J</b>		Paradyne	76
<b>1079</b>	Compact Devices	129		JavaSoft	95	Performance Telecom	76
<b>1089</b>	Compaq Computer	139		<b>K</b>		Phar Lap Software	112NA 1
	Computer Associates	101		<b>1068</b> KeyLabs	167	Philips	32IS 3
	The Computer Group	87		Keyware Technologies	32IS 19	Philips Speech Processing	32IS 19
	Computer Sciences	87		Kiva Software	87	Phonetic Systems	32IS 19
<b>998</b>	ConSol Consulting & Solutions	32IS 23		Kurzweil AI	32IS 19	Poet Software	101
	CRC Business Solutions	87		<b>L</b>		<b>1038</b> , Practical Peripherals	76
	Creative Design Solutions	18		LANart	120C	Prolifics	87
<b>1071</b>	Cubic VideoCom	167		LANcomp	87	Psion Software PLC	45
<b>978</b>	CyberMax Computer	33		LANQuest	63	<b>Q</b>	
	<b>D</b>			LCI Computer Group	32IS 3	ONX Software Systems	112NA 1
	Data Fellows	32IS 7		Lernout & Hauspie	32IS 19	<b>R</b>	
<b>995</b>	Data Technologies	32IS 23		<b>1060</b> Lexmark	167	Radguard	32IS 7
						<b>X</b>	
						<b>1011</b> Xtenso Software	32IS 23
						<b>Z</b>	
						Zona Research	87
						<b>1042</b> , Zoom Telephonics	76
						<b>1043</b>	
						<b>1044</b> Zypcom	76
						<b>1026</b> ZyXel	76

IS pages appear only in the International edition. NA pages appear only in the North America edition. C and K pages appear only in the Reseller edition.

end Infinia 7260 (\$2899) has a 266-MHz Pentium II processor, a 6.4-GB hard drive, and 64 MB of EDO DRAM. All systems offer one-touch Internet access: A button mounted on the monitor gives you access to e-mail and special-interest Web sites through a Web service that Toshiba provides. *Contact: Toshiba America Information Systems, Inc., Irvine, CA, 800-457-7777; <http://www.computers.toshiba.com>.* Enter 1049 on Inquiry Card.

## More-Powerful 3-D Workstations

INTERGRAPH'S TDZ 2000 3-D GRAPHICS workstations (from \$10,495) come with a 300-MHz Pentium II processor, a Realizm II 3-D graphics accelerator, 64 MB of RAM, a 4-GB hard drive, a 24X CD-ROM drive, and a floppy drive. The TDZs, powered by single and dual 300-MHz Pentium II processors, feature Intergraph's Realizm II OpenGL 3D graphics and DirectBurst technology. Offering up to 63.2 GB of disk storage, they support up to 11 PCI slots, 3-D graphics enhancements, peripherals, and disk subsystems. *Contact: Intergraph Computer Systems, Huntsville, AL, 800-763-0242; <http://www.intergraph.com>.* Enter 1087 on Inquiry Card.

## New Pentium II Systems

THE PENTIUM II DELL DIMENSION XPS "D" line comes with 233- or 266-MHz Pentium II processors and uses Intel's new 440LX chip set. The sys-



tems range in price from \$2399 to \$3799 and offer such features as an 8.4-GB hard drive, 4 MB of video memory, an optional 19-inch mon-

itor, and a 24X Max Variable CD-ROM drive.

*Contact: Dell Computer Corp., Austin, TX, 512-728-4100; <http://www.dell.com>.* Enter 1050 on Inquiry Card.

## Multifunction

### One-Stop Shopping

CANON'S MULTIPASS C3000 (\$549) CAN handle all your printing, scanning, faxing, and copying needs for the home or small-office environment. The MultiPass is a four-color ink-jet printer with 400-dpi capability and a built-in scanner with 256 gray scales. It can receive and print plain-paper faxes or send PC faxes directly from most Windows applications.



The unit measures 15.75 inches wide, 14.2 inches deep, and 7.75 inches high, and it weighs 13.2 pounds.

*Contact: Canon Computer Systems, Inc., Costa Mesa, CA, 800-848-4123; <http://www.ccsi.canon.com>.* Enter 1056 on Inquiry Card.

## Videoconferencing

### Videoconference on the Road

THE WINNOV VIDEUMCAM DESKTOP (\$299) and Traveler (\$299) videoconferencing cameras provide 352-by-240-pixel resolution and 16.7 million colors for portable or desktop computers. About the size of a computer mouse, the PC version has an ISO card for installation on a desktop PC, and the portable version has a Type II PC Card adapter for connecting to a laptop. The cameras support all industry video-

conferencing protocols and work with Microsoft NetMeeting, White Pine's CU-SeeMe, VDOnet VDO-Phone, and other videoconferencing software. The units have a 90-MHz Pentium and 16 MB of RAM and run with Windows 95 or NT 4.0. *Contact: Winnov, Sunnyvale, CA, 408-733-9500; <http://www.winnov.com>.* Enter 1058 on Inquiry Card.

## Cards

### Quick on the Draw

THE POWERSTORM 4D30T (\$2999) FROM Digital is a new midrange graphics accelerator for high-performance 2-D and 3-D graphics in the desktop/workstation environment. This single-slot board is based on a chip from Evans & Sutherland that provides a 16-MB frame buffer and 1280 by 1024 resolution. The PowerStorm can draw 2 million triangles per second and perform most texture-mapping jobs, limited only by the amount of memory loaded on your system.

*Contact: Digital Equipment Corp., Maynard, MA, 800-344-4825; <http://www.workstation.digital.com>.* Enter 1057 on Inquiry Card.

## Copiers

### Color Copiers

HEWLETT-PACKARD HAS USED ITS INK-JET and scanner technologies to create two series of color copiers. The Color Copier 200 series (\$999) copies black-and-white documents at up to 10 copies per minute and prints at 600 by 600 dpi in both color and monochrome. The Color Copier 100 series (\$699) has 600- by 300-dpi printing capabilities in color and 600 by 600 in monochrome. Print speeds are up to 7 cpm in monochrome and 3 cpm in color. An automatic multicopy document feeder with 40-sheet capacity is available for the 200 series.

*Contact: Hewlett-Packard Co., Palo Alto, CA,*

800-752-0900; <http://www.hp.com>.

Enter 1086 on Inquiry Card.

## Storage

### New Disk Drive Technology

THE LS-120 DISKETTE HAS THE SAME shape and size as a standard 1.44-MB 3½-inch diskette, but it has a formatted storage capacity of 120 MB. The Imation SuperDisk Drive (\$199) is an external parallel-port drive for LS-120 disks. The technology places optical reference tracks on the diskette that are written and read by a laser system. The optical sensor in the drive allows the read/write head to be precisely positioned over the magnetic data tracks, enabling track densities of 2490 data tracks per inch, versus 135 tpi for a 1.44-MB diskette.

*Contact: Imation, Oakdale, MN, 888-466-3456 or 612-704-4000; <http://www.imation.com>.* Enter 1057 on Inquiry Card.

## Printer

### A Small, Colorful Ink-Jet Printer

THE LEXMARK 1000 OFFERS 600- by 600-dpi color printing for a mere \$139. Measuring 14.2 inches wide, 6.3 inches deep, and 6 inches high, the unit weighs 8½ pounds. Its paper-

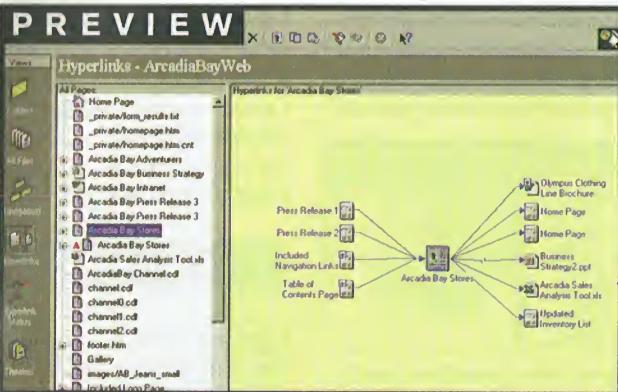


handling tray holds 30 sheets, it can print 3.5 ppm in black ink and 1.5 ppm in color, and it handles banner printing, manually fed envelopes, and transparencies. It works with Windows 95, 3.1, and 3.11. *Contact: Lexmark International, Inc., Lexington, KY,*

fits into a drive bay on a server and connects through a SCSI adapter. Up to seven units can be supported on a single SCSI chain. nCipher works with general-purpose RISC processors, using custom and standard logic to speed the encryption process for on-line commerce. SET and SSL are the protocols that nFast

uses for electronic commerce; the program also provides support for standard algorithms, including RSA and DES.

*Contact: nCipher Corp., Ltd., Cambridge, U.K., +44 1223 723 600; <http://www.ncipher.com>. Enter 1074 on Inquiry Card.*



**FrontPage 98**  
**\$149 (\$40 rebate for registered Office users; upgrade from FrontPage 1.1 or higher, \$54.95)**

**Enter 1063 on Inquiry Card.**

**Microsoft Corp.**  
 Redmond, WA  
 800-426-9400  
 206-882-8080  
 fax: 206-936-7329  
<http://www.microsoft.com>

## FrontPage 98 Adds Refinement to Web Publishing

**M**icrosoft's FrontPage 98 improves on a product that's already hugely popular with hobbyists, novices, and professional Webmasters alike. FrontPage 98 adds support for more of the latest Web features, including Cascading Style Sheets (CSS) and Dynamic HTML (DHTML), and it makes publishing your content easy with Microsoft's channel definition format (CDF).

The package can also be used to create top-notch interactive and animated Web pages for publication on any Web server, although you lose some functionality on servers that don't support FrontPage extensions.

Microsoft improves site design by including over 50 different schemes, with looks ranging from funky retro-fifties to button-down corporate. Each scheme can be modified to mute or blast colors or to use hefty animated graphics or lightweight but stationary images for quicker downloads. Background schemes are easily customizable. FrontPage simplifies the task of building Web forms and lets you e-mail yourself any data collected on-line or store it locally in either ASCII tab-delimited or HTML format.

The pain of table building is eased as FrontPage makes the task totally graphical, replacing hit-or-miss manual entry scripting of table, row, and cell dimensions with a pencil tool for graphical table creation. You can now edit a Web page locally, without the server running, which lessens dependence on a local Web server during production. In all, FrontPage is a more functional update to a product that's already nearly an industry standard. —Pete Loshin

## E-Mail

### Safeguard Your E-Mail Attachments

HILGRAEVE'S DROPCHUTE+ (\$50) aims to ease the delivery of large e-mail attachments. This software verifies the delivery of e-mail attachments and has a drag-and-drop interface for DropChute+ users to exchange files in real time. The Internet Rendezvous feature makes it possible to send e-mail anytime without having to schedule time on the Internet, and it also saves users long-distance phone charges. This feature works by sending a 2-second message to another PC running DropChute+ software and tells it when and where to rendezvous on-line. It then hangs up the phone, and the two PCs connect automatically through the Internet. DropChute+ detects and blocks viruses in received data, and users can deploy Microsoft Cryptography APIs or any third-party security product for encryption.

*Contact: Hilgraeve, Inc., Monroe, MI, 313-243-0576; <http://www.hilgraeve.com>. Enter 1075 on Inquiry Card.*

### Video E-Mail for Eudora

EUDORA E-MAIL USERS NOW HAVE A TOOL for compressing, decompressing, and recording e-mail video messages. CVVideo-Mail (\$200) includes a bundled video-capture board and has a file-management system for storing, saving, and deleting video



e-mail messages. It's EMSAPI-compliant, works with most desktop video cameras, and is integrated into Eudora with an icon that activates the CVVideo-Mail application.

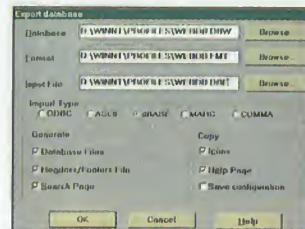
*Contact: Cubic VideoComm,*

*San Diego, CA, 619-505-2030; <http://www.cvideonow.com>. Enter 1071 on Inquiry Card.*

## Database

### Instant HTML

THE SHOWBASE EXTRA 2.0 PROGRAM (\$1499 to \$4499, depending on platform) converts dBase, ODBC-compliant, MARC, ASCII, and comma-delimited database files into



Internet-ready pages without requiring HTML coding. A Wizard interface facilitates the point-and-click conversion of files into Web-ready documents, and ShowBase Extra refreshes documents periodically from a database, eliminating the need to manually update Web pages created with this program. ShowBase Extra has a search engine that supports seven languages, and it supports 40 database packages, including Oracle, Sybase, Informix, and DB2. With bundled Java APIs, users can build custom front-end interfaces.

*Contact: ShowBase, Inc., Aylmer, Quebec, Canada, 819-685-2273; <http://www.ShowBase.com>. Enter 1072 on Inquiry Card.*

## Programming

### Control the Development Process

CYRANO CLIENTPACK FOR WINDOWS (\$2250) lets you plan, manage, and analyze your testing procedures. Once you specify a project's standards, you can use ClientPack to automate compliance with such things as file-naming conventions for contracted programmers. CyranodDBPack (\$10,000) helps you tune

# improbable

*The green screen, like certain rock bands that won't stay away, makes a comeback.*

## Advances and Retreats in Computing

In computing, the old days never really go away. Software vendors (such as Wall Data) now offer programs that let you use the newest of the new (the World Wide Web) to access the oldest of the old (thousands and thousands of clunky IBM mainframes and other "legacy systems" that run poorly written, but important, programs and keep generations of COBOL and FORTRAN coders in dull but lucrative employment). Now hardware manufacturers, with some prodding from the Calvin Klein crowd, are about to bring back the green screen.

To use the correct terminology, as described in the glow-in-the-dark-phosphorescent-paint-encrusted press packet that is clogging up one of our desks: Get ready for "the GreenScreen!"

The manufacturer, the imaginatively named GreenScreen! Company, is insistent on that exclu-

around but that we listen to now because they remind us of better

### eight-tracks bell-bottoms green screens

mation point. The GreenScreen! terminals retail for \$4.95 (that's right—four dollars and 95 cents). The low price is possible because these are literally old terminals, salvaged in bulk from crumbling warehouses and dumpsters across America. Most of them don't work, but, as you'll see in a moment, that's beside the point.

The terminals are described as "fashion accessories for the home, office, or salon." What is GreenScreen! Company *really* selling? GreenScreen! software tools, that's what. The theory is that people crave, absolutely crave, the feel of the '50s and '60s. And '70s. And '80s. "Eagle" rock stations play songs we didn't like too much the first time

songs that were played at the time. Bell-bottoms are back, and supposedly Elvis keeps coming back—so why not, the thinking goes, bring back green screens?

GreenScreen!'s new Web Access GreenProgram! lets you return to the

'70s (and beyond) with what the manufacturer calls "lovably horrible green-screen terminal access." You can have the quietly utter thrill of viewing anything on the Web as if it were really an old-fashioned clunky green screen. It's a subtle delight, perhaps, but for some people, presumably, a very real one.

GreenScreen! plans to release other '70s, '60s, and '50s throwback products, too—everything from hand-soldered circuit boards to magnetic cores. Yes, truly, old memory can be yours forever.



O  
T  
R  
E  
R  
R  
A  
C  
K  
E  
T

## Racket

### A CONTEST WITH HOLES IN IT

We, too, are developing a catalog's worth of retro-computing KitschWare™, beginning with a line of tradable punchcard products. If you are under the age of 40 and have never seen a genuine computer punchcard, you are in for a treat.

To kick off the enterprise: a contest. Whose signature would you like to see on a collectible punchcard? Johnny Von Neumann? An Wang? Grace Hopper? Alan Turing? Ken Olsen? Guglielmo Marconi? And what kinds of statistics should be printed on the back? Send your nominations to [marca@improb.com](mailto:marca@improb.com). The winners, if any, will receive a 360K floppy autographed (right on the working surface) by the editors of BYTE.

We are also creating a line of autographed punchcard chaff.



Marc Abrahams is director of the Ig Nobel Prize ceremony, which will be telecast live on <http://www.improb.com> on Oct. 9, 7:30 p.m. EST.



Tatung manufactures a full range of 14", 15", 17" and 20" colour monitors to satisfy the requirements of diverse range of product markets.

Monitors specifically designed for entry level, home use, small business, multimedia, government, and for the professional CAD/CAM and DTP user are readily available. All Tatung monitors comply with world-wide approvals for safety, EMC and Ergonomics including MPRII and TCO.

### Visual Display Business Unit.

The Tatung Visual Display Business Unit can offer a full range of monitors, both on a branded or OEM basis.

Tatung also guarantees:

- . Continuity in quality and supply, as Tatung is one of the few manufacturers has its own CDT plants.
- . Continuous innovation and development through world-wide R&D operations.
- . An exceptional after-sales service, including on-site repairs, within 48 hours.
- . Full global sales, marketing, purchasing and distribution facilities.

**Contact us now for further details...**

# THE IDEAL MONITOR FOR ANY PC

C7G series  
(CM17G series)

C4A series

C5VYR

CM20MVR



 **TATUNG**

**VISUAL DISPLAY BUSINESS UNIT**

TATUNG Co.  
Visual Display Business Unit  
22 Chungshan N. Rd, 3rd Sec.  
Taipei, Taiwan, 10451, R.O.C.  
TEL: 886-2-5925252 Ext. 2402, 2521, 2536,  
2250, 2243, 2903  
FAX: 886-2-5984477, 5924569, 5915185  
WWW: <http://www.tatung.com.tw/>  
E-Mail: [tlclee@thg.tatung.com.tw](mailto:tlclee@thg.tatung.com.tw)  
FTP: [ftp.tatung.com.tw](ftp://ftp.tatung.com.tw)

TATUNG Co. of America, Inc.  
2850 E1 Presidio Street,  
Long Beach, CA 90810, U.S.A.  
TEL: 1-213-979-7055, 310-637-2105  
FAX: 1-310-637-8484  
E-Mail: [mlee@tatungusa.com](mailto:mlee@tatungusa.com)  
Attn: Mr. Mike Lee

TATUNG (U.K.) Ltd.  
Stafford Park 10,  
Telford, Shropshire, TF3 3AB  
England  
TEL: 44-1952-290111  
FAX: 44-1952-290390  
E-Mail: [uktalk@tatung.co.uk](mailto:uktalk@tatung.co.uk)  
Attn: Mr. Simon Chao

TATUNG International (Deutschland)GmbH  
Max-Planck-Strasse 42,  
50858 Köln(Mandorf), Deutschland  
Germany  
TEL: 49-2234-2140  
FAX: 49-2234-214310  
E-Mail: [tuktalk@tatung.co.uk](mailto:tuktalk@tatung.co.uk)  
Attn: C/O Mr. C.Y. Yang

TATUNG Co. of Japan Inc.  
Sanko Bldg., Honkan, 2F, 10-5,  
Ginza 4-Chome, Chuo-Ku,  
Tokyo 104, Japan  
TEL: 3-3545-2969, 3545-2205  
FAX: 3-3545-3155  
E-Mail: [ctlin@tatung.co.jp](mailto:ctlin@tatung.co.jp)  
Attn: Mr. C.T. Lin

TATUNG Liaison Office, R.O.K.  
Room 1105, Guhsung Bldg.,  
No.541, Dowsa-Dong, Mapo-Ku,  
Seoul, Korea  
TEL: 82-2-718-7137, 718-8970  
FAX: 82-2-718-7825  
Attn: Mr. C.C. Tseng

TATUNG (THAILAND) Co., Ltd.  
39/24-25, 17th Fl., Amornphan 205 Tower 1,  
Soi Nathong, Ratchadapisek Road, Din Dang, Bangkok  
10320, Thailand  
TEL: 662-248-7621~3  
FAX: 662-248-7620  
E-Mail: [rd.tatung@kouinfo.co.th](mailto:rd.tatung@kouinfo.co.th)  
Attn: Mr. K.Y. Wang

TATUNG Electronics (Singapore) Pte. Ltd.  
No 4, 1st Lokyong Rd.,  
Jurong Town  
Singapore 22  
TEL: 65-3656526, 2655297  
FAX: 65-2687404  
TLX: RS 25482 TATUNG S  
E-Mail: [tatungs@singnet.com.sg](mailto:tatungs@singnet.com.sg)  
Attn: Mr. C.K. Wong

# Sometimes, a Family's Greatest Strength is its Diversity



Family is important. Without the comfort of familiarity, you'd never have the courage to be a little different. Our newest switch family shares some very comforting features. Controlling multiple PCs from one keyboard, monitor and mouse has never been simpler. Just select your PC from an easy on-screen menu; naming your computers makes identification a snap! Our advanced design even lets you add PCs without powering down the switch. If the switch is powered down unexpectedly, the Keep Alive feature prevents you from losing valuable time and data.

Beyond this shared technology, these products are each tailored for different needs.

**Personal Commander II** controls two to four PCs in your home or office. **AutoBoot Commander II** is the perfect size for the desktop or small data center. Use the **AutoView Commander** for rack-mounted control in your server room.

Isn't family great? For more information on this exciting new switch family, call our sales department anytime.

Oh, and don't forget to call your mother; you know how she worries.



Cybex Europe Limited  
Cydex House, Shannon Free Zone  
Shannon, Co. Clare, Ireland  
Tel: 353-61-471877, Fax: 353-61-471871  
Email: sales@cybex.ie  
Website: <http://www.cybex.ie>



AutoView, Commander and AutoBoot are trademarks of Cybex Computer Products Corporation. Cybex and the Cybex logo are registered trademarks of Cybex Computer Products Corporation. Banyan is a trademark of Banyan Systems Inc. Netware is a registered trademark of Novell Inc. Lantastic is a registered trademark of Artisoft Inc.